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The Journal *of the* Society of Dyers and Colourists

Volume 76



Number 9

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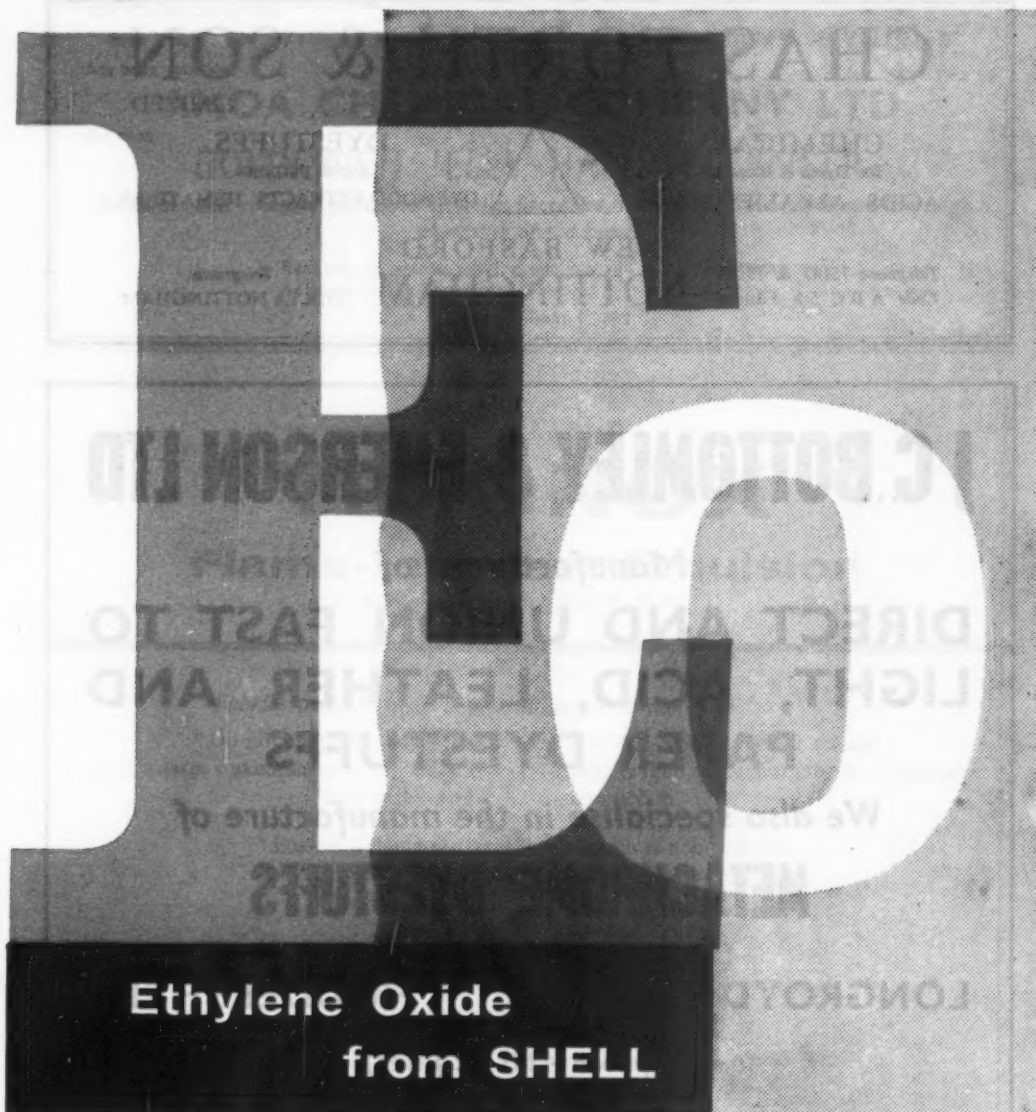
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FORTHCOMING MEETINGS OF THE SOCIETY

Thursday, 6th October 1960

MIDLANDS SECTION. *Fibre Identification*—a lecture demonstration. C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C., and F. W. Lindley, Esq., Ph.D. (Courtaulds Ltd.). (Joint meeting with the Nottingham Textile Society.) Gas Showrooms, Nottingham. 7 p.m.

Friday, 7th October 1960

LONDON SECTION. *Science in Industry*. Prof. C. F. Carter (Faculty of Economic and Social Studies, University of Manchester). Royal Society, Burlington House, London W.1. 6 p.m.

Tuesday, 11th October 1960

NORTHERN IRELAND SECTION. *Problems Involved in Piece Dyeing with Vat Dyestuffs*. M. M. Brauer, Esq., Tex. Ing. (Badische Anilin & Soda Fabrik AG.). Grosvenor Rooms, Belfast. 7.30 p.m.

SCOTTISH SECTION. *Questions of Current Interest in Resin Finishing*. Dr. W. Rumens (Badische Anilin & Soda Fabrik AG.). St. Enoch Hotel, Glasgow. 7.15 p.m.

Thursday, 13th October 1960

THE SIXTH GEORGE DOUGLAS LECTURE. *Wool as a Fibre in Dyeing and Finishing*. A. B. D. Cassie, Esq., C.B.E., M.A., D.Sc., F.Inst.P. (Director of Research, Wool Industries Research Association Ltd.). Midland Hotel, Bradford. 7.15 p.m.

Saturday, 15th October 1960

MIDLANDS SECTION. Annual Ladies Evening, Dinner Dance. The Grand Hotel, Leicester. 7 p.m.

Tuesday, 18th October 1960

HUDDERSFIELD SECTION. *Vigoureux or Mélange Printing*. E. Lupton, Esq. (H. Fletcher & Co. Ltd.). Silvios Cafe, Huddersfield. 7.30 p.m.

Wednesday, 19th October 1960

LONDON SECTION. *Necessity, Invention and Rayon*. J. G. Evans, Esq., B.Sc.Tech., M.Sc.Tech. (Research and Development Director, Bradford Dyers' Association Ltd.). (Joint meeting with the Dyeing and Finishing Sub-committee of the International Rayon and Synthetic Fibres Committee.) The President of the Society of Dyers and Colourists—F. M. Stevenson, Esq., J.P., M.Sc., will take the chair. Royal Society, Burlington House, London W.1. 6 p.m.

Thursday, 20th October 1960

MANCHESTER SECTION. *Symposium on Bonded Fibre Fabrics*. (Joint meeting with the Society of Chemical Industry (Paper and Textile Chemicals Group) and the Textile Institute.) Lesser Free Trade Hall, Manchester. 9.30 a.m.

Friday, 21st October 1960

LONDON SECTION. Eighth London Lecture. *Colour and Design in Dress Fabrics*. S. J. R. Leeming, Esq. (Samuel Courtauld & Co. Ltd., Halstead). Waldorf Hotel, Aldwych, London W.C.2. 7 p.m.

NORTHERN IRELAND SECTION. Dinner Dance. Woodbourne House Hotel.

WEST RIDING SECTION. *Supper and Smoker*. The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Wednesday, 26th October 1960

MIDLANDS SECTION. *Influence of Newer Fibres on Beam Dyeing*. P. J. Dolby, Esq., B.Sc. (Imperial Chemical Industries Ltd.). Kings Head, Loughborough. 7 p.m.

Thursday, 27th October 1960

MANCHESTER JUNIOR BRANCH. *Modern Machinery Developments*. J. V. Horsley, Esq. (Mather & Platt Ltd.). Room J/E, 11 Jackson Street Extension, College of Science and Technology, Manchester. 4.30 p.m.

Monday, 31st October 1960

BRADFORD JUNIOR BRANCH. *Fibre Identification*. F. W. Lindley, Esq., Ph.D., and C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C. (Courtaulds Ltd.). Institute of Technology, Bradford. 7.15 p.m.

Tuesday, 1st November 1960

SCOTTISH SECTION. *A New Understanding of Skittery Dyeing and Its Practical Significance*. H. R. Hadfield, Esq., M.Sc.(Tech.), and D. R. Lemm, Esq., B.Sc. (Imperial Chemical Industries Ltd.). Room 24, Royal College of Science and Technology, Glasgow. 7.15 p.m.

Wednesday, 2nd November 1960

SCOTTISH JUNIOR BRANCH. *Fibre Identification*—a lecture demonstration. F. W. Lindley, Esq., Ph.D. and C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C. (Research Laboratory, Courtaulds Ltd.). Technical College, George Street, Paisley. 7.30 p.m.

Thursday, 3rd November 1960

WEST OF ENGLAND AND SOUTH WALES SECTION. *Paper Chromatography of Dyestuffs*. J. Brown, Esq. (CIBA Clayton Ltd.). County Hotel, Taunton. 6.30 p.m.

Friday, 4th November 1960

LONDON SECTION. *Fastness of Dyes and Finishes*. A. J. Lenz, Esq. (Director of the Retail Trading-Standards Association Testing House). Royal Society, Burlington House, London W.1. 6 p.m.

Thursday, 10th November 1960

WEST RIDING SECTION. *A New Understanding of Skittery Dyeing and its Practical Significance*. H. R. Hadfield, Esq., M.Sc.(Tech.) and D. R. Lemm, Esq., B.Sc.(Hons.). (Imperial Chemical Industries Ltd.). The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Tuesday, 15th November 1960

HUDDERSFIELD SECTION. *A New Understanding of Skittery Dyeing and Its Practical Significance*. H. R. Hadfield, Esq., M.Sc.(Tech.) and D. R. Lemm, Esq., B.Sc.(Hons.). (Imperial Chemical Industries Ltd.). Silvios Cafe, Huddersfield. 7.30 p.m.

SCOTTISH JUNIOR BRANCH. *The Breakage of Twisted Yarns*. Dr. T. W. S. Hearle, M.A., A.Inst.P. (College of Science and Technology, Manchester). Joint Meeting with the Textile Institute. Technical College, George Street, Paisley. 7.30 p.m.

Wednesday, 16th November 1960

MIDLANDS SECTION. *Skittery Dyeing*. H. Hadfield, Esq., M.Sc. and W. Lemm, Esq., B.Sc. (Imperial Chemical Industries Ltd.). (Joint meeting with the Leicester Branch of The Guild of Technical Dyers.) College of Art and Technology, Leicester. 7 p.m.

Thursday, 17th November 1960

HUDDERSFIELD SECTION. Annual Dinner. Whiteley's Cafe, Huddersfield.

MANCHESTER JUNIOR BRANCH. *Recent Developments in Dyeing Acrylic Fibres*. B. Kramrisch, Esq., F.R.I.C., F.T.I., F.S.D.C. (CIBA Clayton Ltd.). Room J/E.11, Jackson Street Extension, College of Science and Technology, Manchester. 4.30 p.m.

MANCHESTER SECTION. *The Dyeing of Courtauld—Some Aspects of Practical Bulk Dyeing and Finishing*. J. S. Ward, Esq., B.Sc. (Courtaulds Ltd.). Lecture Theatre, Manchester Literary and Philosophical Society, Back-George Street, Manchester 1. 7 p.m.

Tuesday, 22nd November 1960

BRADFORD JUNIOR BRANCH. *The Dyeing of Courtauld*. K. Meldrum, Esq., B.Sc., A.R.I.C. (Courtaulds Ltd.). Institute of Technology, Bradford. 7.15 p.m.

SCOTTISH SECTION. *The Role of Hydrogen Peroxide, Peracetic Acid and Sodium Chlorite in Bleaching*. L. A. Chesner, Esq., B.Sc., A.T.I. (Laporte Chemicals Ltd.). St. Enoch Hotel, Glasgow. 7.15 p.m.

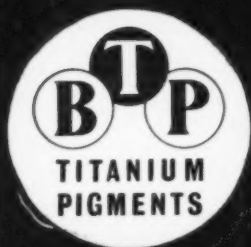
Thursday, 24th November 1960

WEST RIDING SECTION. *Fibre Identification*—a lecture demonstration. F. W. Lindley, Esq., Ph.D., and C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C. (Courtaulds Ltd., Droylsden). The Hotel Metropole, King Street, Leeds. 7.30 p.m.

Thursday, 1st December 1960

NORTHERN IRELAND SECTION. *The Procion Resin Process*. I. D. Rattee, Esq., B.Sc., A.R.C.S. (Imperial Chemical Industries Ltd.). Grosvenor Rooms, Belfast. 7.30 p.m.

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FORTHCOMING MEETINGS OF THE SOCIETY — continued from page iv**Thursday, 1st December 1960**

WEST OF ENGLAND AND SOUTH WALES SECTION. *The Application and Uses of the Synthetic Vinyls in the Textile Industry.* Dr. MacGregor (Courtaulds Ltd.). Park Hotel, Cardiff. 6.30 p.m.

Friday, 2nd December 1960

LONDON SECTION. *Dyeing Furnishing Fabrics in London.* R. Hawthorn, Esq. (Henry W. Gibbs Ltd.) (Joint meeting with the London Section of The Textile Institute.) Royal Society, Burlington House, London W.1. 6 p.m.

Monday, 5th December 1960

MANCHESTER JUNIOR BRANCH. *High Polymers.* Professor C. E. H. Bawn (University of Liverpool). Room J/E.11, Jackson Street Extension, College of Science and Technology, Manchester. 4.30 p.m.

Wednesday, 7th December 1960

BRADFORD JUNIOR BRANCH. *The Principles of Colour Photography.* C. W. Taylor, Esq. (Ilford Ltd.). Institute of Technology, Bradford. 7.15 p.m.

Thursday, 8th December 1960

SCOTTISH JUNIOR BRANCH. *Recent Developments in the Application of Dyes to Polyamide Fibres with special reference to Continuous Processes.* R. E. Fletcher, Esq. (CIBA Clayton Ltd.). Technical College, George Street, Paisley. 7.30 p.m.

Friday, 9th December 1960

WEST RIDING SECTION. Symposium. *New Dyeing Techniques* (Details later). Institute of Technology, Bradford.

Tuesday, 13th December 1960

SCOTTISH SECTION. *Modern Flow Principles and Machine Design.* (With particular reference to package and high temperature beam dyeing.) G. S. Helliwell, Esq. (Samuel Pegg & Son Ltd.). St. Enoch Hotel, Glasgow. 7.15 p.m.

Thursday, 15th December 1960

MANCHESTER SECTION. Ladies Evening. *Carpets.* The Great Hall, College of Science and Technology, Manchester. 7 p.m.

MIDLANDS SECTION. Half-day symposium on *Chemical Finishing.*

Stimulus and Response. Dr. Madaras and S. N. Bradshaw, Esq.

Easy Care Finishes on Viscose Rayon. D. H. Ogden, Esq. (British Rayon Res. Assoc.).

Surfactants in Resin Finishing. C. D. Moors, Esq. (Glovers Chemicals Ltd.).

Chemistry of Resins. A. R. Smith, Esq., B.A., B.Sc., F.R.I.C. (B.I.P. Chemicals Ltd.).

Charge for symposium 2s. 6d. including afternoon tea. Daybrook House, Daybrook, Nottingham. 2.15 p.m.

Tuesday, 20th December 1960

HUDDERSFIELD SECTION. *The Dyeing of Courtelle.* J. S. Ward, Esq., B.Sc. (Courtaulds Ltd.). Silvios Cafe, Huddersfield. 7.30 p.m.

Tuesday, 10th January 1961

NORTHERN IRELAND SECTION. *The Dyeing and Finishing of the Newer Synthetic Fibres as They Affect the Consumer.* J. S. Ingham, Esq., M.Sc., F.R.I.C., F.S.D.C. (Marks and Spencer Ltd.). Grosvenor Rooms, Belfast. 7.30 p.m.

Thursday, 12th January 1961

SCOTTISH SECTION. *Recent Developments in Wool Dyeing.* D. G. Evans, Esq., B.Sc. (CIBA Clayton Ltd.). Scottish Woollen Technical College, Galashiels. 7.30 p.m.

WEST RIDING SECTION. *Modern Piece Scouring Methods in Relation to Uneven Dyeing.* B. F. J. Moxon, Esq. (Wool Industries Research Association Ltd.). The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Friday, 13th January 1961

LONDON SECTION. *Fibre Identification*—a lecture demonstration. F. W. Lindley, Esq., Ph.D., and C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C. (Courtaulds Ltd., Droylsden). (Joint meeting with the London Centre of the Guild of Dyers and Cleaners.) Royal Society, Burlington House, London W.1. 6.30 p.m.

Monday, 16th January 1961

BRADFORD JUNIOR BRANCH. *Moths and Mothproofing.* A. Gabriel, Esq., B.Sc. (Shell Chemical Co. Ltd.). Institute of Technology, Bradford. 7.15 p.m.

Tuesday, 17th January 1961

HUDDERSFIELD SECTION. *Defending the Frontiers of Civilisation.* J. David, Esq., B.Sc.(Tech.), A.M.C.T., A.T.I. (Catomance Ltd.). (Joint meeting with Halifax Textile Society.) Silvios Cafe, Huddersfield. 7.30 p.m.

SCOTTISH SECTION. *Continuous Dyeing of Synthetic Fibres and Their Blends with Other Fibres.* J. Khacheyan, Esq. (C.F.M.C.). St. Enoch Hotel, Glasgow. 7.15 p.m.

Wednesday, 18th January 1961

MIDLANDS SECTION. (Title later). G. H. Lister, Esq., Ph.D. King's Head, Loughborough. 7 p.m.

Thursday, 19th January 1961

MANCHESTER SECTION. *Printing of Synthetic Fibres.* R. E. Fletcher, Esq., B.Sc., A.T.I. (CIBA Clayton Ltd.). Lecture Theatre, Manchester Literary and Philosophical Society, Back-George Street, Manchester 1. 7 p.m.

MANCHESTER JUNIOR BRANCH. *Fibre Identification.* F. W. Lindley, Esq., Ph.D. and C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C. (Research Dept., Courtaulds Ltd.). Room J/E.11, Jackson Street Extension, College of Science and Technology, Manchester. 4.30 p.m.

Friday, 20th January 1961

WEST RIDING SECTION. Annual Dinner and Dance. Victoria Hotel, Bradford.

Thursday, 26th January 1961

WEST RIDING SECTION. (Title later). R. L. Elliott, Esq., Ph.D.(London), F.R.I.C., F.T.I., F.S.D.C. The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Friday, 27th January 1961

LONDON SECTION. Annual Dinner and Dance. Waldorf Hotel, Aldwych, London W.C.2. 7 p.m. for 7.30 p.m.

Monday, 30th January 1961

HUDDERSFIELD SECTION. *Modern Piece Scouring Methods in Relation to Uneven Dyeing.* B. F. J. Moxon, Esq. (Wool Industries Research Association Ltd.). (Joint meeting with the Huddersfield Textile Society.) College of Technology, Huddersfield. 7.30 p.m.

Friday, 3rd February 1961

LONDON SECTION. *Dyeing of Millinery and Allied Materials.* Short papers by members of Barford Bros. Ltd., Luton. Royal Society, Burlington House, London W.1. 6 p.m.

Tuesday, 7th February 1961

NORTHERN IRELAND SECTION. *Science in the Detection of Crime.* Dr. A. J. Howard (Director of the Department of Industrial Forensic Science). Joint meeting with the Textile Institute. Chamber of Commerce Board Room, Donegall Square West, Belfast. 7.30 p.m.

Wednesday, 8th February 1961

MIDLANDS SECTION. *Work Study in the Dyehouse.* B. Lockwood, Esq., and R. W. Richardson, Esq., Ph.D., B.Sc., A.R.I.C. (Furzebrook Knitting Co. Ltd.). College of Art and Technology, Leicester. 7 p.m.

Thursday, 9th February 1961

WEST OF ENGLAND AND SOUTH WALES SECTION. *Trade Effluents—The Legal Position and Method of Treatment.* J. H. Harwood, Esq. (Peter Spence & Sons Ltd.). County Hotel, Taunton. 6.30 p.m.

WEST RIDING SECTION. *The Problem of Illumination in Colour Matching.* K. McLaren, Esq., B.Sc., F.R.I.C., F.S.D.C. (Imperial Chemical Industries Ltd.). The Hotel Metropole, King Street, Leeds. 7.30 p.m.

Tuesday, 14th February 1961

BRADFORD JUNIOR BRANCH. *Modern Piece Scouring Methods in Relation to Uneven Dyeing.* B. F. J. Moxon, Esq. (Wool Industries Research Association). Institute of Technology, Bradford. 7.15 p.m.

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FORTHCOMING MEETINGS OF THE SOCIETY — continued from page vi

Tuesday, 14th February 1961

NORTHERN IRELAND SECTION. *The Principles of Colour Photography.* D. P. Ayres, Esq., B.Sc., A.R.P.S. (Ilford Ltd.). Grosvenor Rooms, Belfast. 7.30 p.m.

SCOTTISH SECTION. *Mechanism of Crease-recovery.* Dr. J. A. Wilson (British Rayon Research Assoc.). (Joint meeting with the Textile Institute.) Room M 406, Royal College of Science and Technology (New Building) Glasgow. 7.30 p.m.

Thursday, 16th February 1961

MANCHESTER JUNIOR BRANCH. *Three short papers by members of the Section.* (Prize donated by Manchester Senior Section.) Room J/E.11, Jackson Street Extension, College of Science and Technology, Manchester. 4.30 p.m.

Friday, 17th February 1961

MANCHESTER SECTION. *The Dye and the Fibre—Study of the Movement of Dye Molecules Within the Fibre.* Dr. R. McGregor (Lecturer in Textile Chemistry, The University of Manchester). Lecture Theatre, Manchester Literary and Philosophical Society, Back-George Street, Manchester 1. 7 p.m.

Tuesday, 21st February 1961

HUDDERSFIELD SECTION. *Some Aspects of the Chemistry of Afterchroming.* L. Peters, Esq., Ph.D., M.Sc. (Leeds University). Silvios Cafe, Huddersfield. 7.30 p.m.

Thursday, 23rd February 1961

WEST RIDING SECTION. *Recent Developments in Dyeing Acrylic Fibres.* B. Kramrich, Esq., F.R.I.C., F.T.I., F.S.D.C. (CIBA Clayton Ltd.). The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Friday, 24th February 1961

LONDON SECTION. *Technical Aspects of Textile Marketing in Relation to the Dyeing and Finishing Industry.* H. A. Thomas, Esq., Ph.D., F.R.I.C., F.T.I., F.S.D.C. (Marketing Division Director, Courtaulds Ltd.). George Hotel, Luton. 6.30 p.m.

Monday, 27th February 1961

HUDDERSFIELD SECTION. *Application of Colour Theory to Fibres, Yarns and Fabrics.* P. Warburton, Esq., M.C., F.S.A.M. (Former Head of Bury Municipal School of Arts and Crafts). Joint Meeting with the Halifax Textile Society. Alexandra Hall, Halifax. 7.30 p.m.

Friday, 3rd March 1961

LONDON SECTION. *Colour Measurement: its possibilities for the Colourist.* H. W. Ellis, Esq., Ph.D., A.R.C.S., A.R.I.C., F.S.D.C. Royal Society, Burlington House, London W.1. 6 p.m.

MIDLANDS SECTION. Annual Dinner. Nottingham Co-operative Society, Upper Parliament Street, Nottingham. 7 p.m.

Tuesday, 7th March 1961

NORTHERN IRELAND SECTION. *The Finishes of 'Terylene' Flax Fabrics.* I. E. Haden, Esq., B.Sc., A.T.I. (Imperial Chemical Industries Ltd.). Grosvenor Rooms, Belfast. 7.30 p.m.

Thursday, 9th March 1961

MANCHESTER JUNIOR BRANCH. **ANNUAL GENERAL MEETING.** *The Standfast Molten Metal Dyeing Machine.* Lecture and Film. A. Ogden, Esq. (Standfast Dyers and Printers Ltd.). Room J/E.11, Jackson Street Extension, College of Science and Technology, Manchester. 4.30 p.m.

MIDLANDS SECTION. *Flameproofing.* (Joint meeting with the Coventry Textile Society.) Courtaulds Acetate and Synthetic Fibres Laboratory, Lockhurst Lane, Coventry. 7 p.m.

WEST RIDING SECTION. *Stimulus and Response—Reactions to Some Current Problems in Textile Finishing.* G. W. Madaras, Esq., Ph.D., and S. N. Bradshaw, Esq. (Courtaulds Ltd., Coventry). The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Tuesday, 14th March 1961

NORTHERN IRELAND SECTION. *General Principles in the Screen Printing of Fabrics made from Natural and Synthetic Fibres.* P. Pyle, Esq., A.R.I.C. (Decorative Fabrics Ltd.). Grosvenor Rooms, Belfast. 7.30 p.m.

Tuesday, 14th March 1961

SCOTTISH SECTION. (Title later). Dr. G. H. Lister (Sandoz Ltd.). St. Enoch Hotel, Glasgow. 7.15 p.m.

Wednesday, 15th March 1961

BRADFORD JUNIOR BRANCH. *The Dyeing of Worsted Pieces.* H. S. Smith, Esq. (CIBA Clayton Ltd.). Institute of Technology, Bradford. 7.15 p.m.

MIDLANDS SECTION. *Early Attempts to Dye Secondary Acetate.* E. Stanley, Esq., and A. J. Wesson, Esq. (British Celanese Ltd.). Celanese Sports Pavilion, Spondon. 7 p.m.

Friday, 17th March 1961

MANCHESTER SECTION. *Textile Finishing Symposium.* (Details to be announced later). Great Hall, College of Science and Technology, Manchester. 2 p.m.

Tuesday, 21st March 1961

HUDDERSFIELD SECTION. *Fibre Identification—a lecture demonstration.* F. W. Lindley, Esq., Ph.D. and C. Beaumont, Esq., B.Sc., A.R.I.C., A.T.I., A.S.D.C. (Courtaulds Ltd.). Silvios Cafe, Huddersfield. 7.30 p.m.

Thursday, 23rd March 1961

MIDLANDS SECTION. *The Dyeing of Blends for Use in Carpets.* R. C. Cheetham, Esq., A.M.C.T., F.R.I.C. (Courtaulds Ltd.). Carpet Trades Ltd., Canteen, Kidderminster. 7 p.m.

WEST OF ENGLAND AND SOUTH WALES SECTION. *Technical Service in the Dyestuffs Industry.* F. North, Esq. (Imperial Chemical Industries Ltd.). The Pillar Room, Mauretania, Bristol. 6.30 p.m.

WEST RIDING SECTION. Annual General Meeting. Followed by *Four Decades with Dicol.* A. J. Wesson, Esq. (Furzebrook Knitting Co. Ltd.). The Victoria Hotel, Bridge Street, Bradford. 7.30 p.m.

Friday, 24th March 1961

LONDON SECTION. Annual General Meeting and Dinner. Waldorf Hotel, Aldwych, London W.C.2. 6.30 p.m. for 7 p.m.

Tuesday, 28th March 1961

SCOTTISH SECTION. Ladies Evening. *Fashion and Mistress Brown, 1780–1880.* R. A. Peel, Esq., F.S.D.C. (Subject will be women's clothes, the colours and dyes, the influence of events—French Revolution, Chartist Movement, Queen Victoria, Mauve and Magenta (i.e. "Coal-Tar" dyes), Church of Scotland, Episcopal Church, etc.—upon the dress of Scotswomen). St. Enoch Hotel, Glasgow. 7.15 p.m.

Tuesday, 11th April 1961

SCOTTISH SECTION. Annual General Meeting. 7 p.m. Followed by *An Instrumental Approach to Colour Matching.* R. Sinclair, Esq., B.Sc., A.S.D.C. at 7.30 p.m. St. Enoch Hotel, Glasgow.

Thursday, 13th April 1961

MIDLANDS SECTION. Annual General Meeting. *Calculations of Fading Rates of Dyes of Different Lightfastness on Exposure to Fluorescent Tubes.* S. M. Jaekel, Esq., B.Sc., A.R.C.S., A.R.I.C. and C. D. Ward, Esq., B.Sc. *Effect of Dry Heat Treatment on the Dye Uptake of Nylon.* S. M. Jaekel, Esq., and D. A. Bampton, Esq., B.Sc. King's Head, Loughborough. 7 p.m.

Tuesday, 18th April 1961

HUDDERSFIELD SECTION. Annual General Meeting. *The Identification of Dyes in Substance and on the Fibre.* G. W. Midgelow, Esq., B.Sc. (Imperial Chemical Industries Ltd.). (Joint meeting with the Huddersfield Section of the Royal Institute of Chemistry.) Silvios Cafe, Huddersfield. 7.30 p.m.

Thursday, 20th April 1961

MANCHESTER SECTION. Annual General Meeting. *Factors Affecting the Efficiency of the Washing Process.* G. J. Parish, Esq., B.Sc., A.Inst.P. (British Cotton Industry Research Association). Lecture Theatre, Manchester Literary and Philosophical Society, Back-George Street, Manchester 1. 7 p.m.

The Journal of the Society of Dyers and Colourists

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NOTICE TO MEMBERS AND SUBSCRIBERS

Readers requiring *general information* regarding the Official Notices, List of Officers of the Society, etc, should consult pages 1-10 of the January 1960 and pages 389-396 of the July 1960 issues of the *Journal*, or write to *The General Secretary*, The Society of Dyers and Colourists, Dean House, 19 Piccadilly, Bradford 1, Yorkshire (Telephone Bradford 25138). *Editorial Communications* should be addressed to *The Editor*, at the same address.

Forthcoming Papers

The following papers have been accepted by the Publications Committee, and will appear in future issues of the *Journal*—

LECTURE

The Use of Colour in Cosmetics

D. F. Anstead

COMMUNICATIONS

Some Physical Properties of Chemically Finished Viscose Rayon
Filament Yarns and Fabrics

D. H. Morton and C. Beaumont

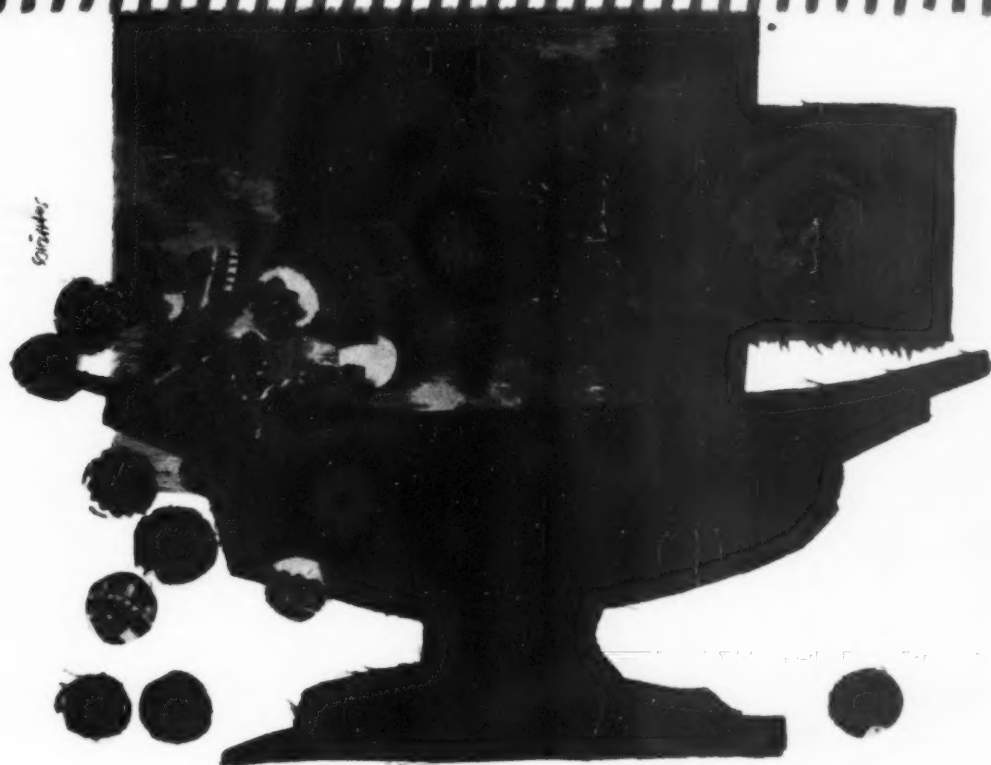
An Autoradiographic Method based on Tritium for Locating
Resin Finish in Textiles

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THE JOURNAL

OF THE

Society of Dyers and Colourists

Volume 76 Number 9

SEPTEMBER 1960

Issued Monthly

Proceedings of the Society

Antistatic Agents in the Textile Industry

A. E. HENSHALL

Meetings of the Midlands Section held jointly with the Nottingham Textile Society at the Gas Board Theatre, Nottingham, on 18th November 1958, Mr. A. W. Carpenter in the chair; of the Scottish Section held jointly with the Textile Institute at the St. Enoch Hotel, Glasgow, on 10th February 1959, Mr. W. G. B. Grant in the chair; of the Huddersfield Section held at Silvio's Café, Huddersfield, on 17th February 1959, Mr. H. Boothroyd in the chair; and of the London Section held in the rooms of the Royal Society, Burlington House, London, on 6th March 1959, Dr. T. H. Morton in the chair

The causes of "static" are discussed and appropriate counter-measures described. Surface-active agents are the most convenient to use and possess the greatest all-round utility in the textile industry. The preferred properties of antistatic agents are given and suitable test methods discussed. Antistatic agents reduce the electrical resistance of fibres and are hygroscopic, but cannot be evaluated solely on the basis of these properties. It is probable that the nature and orientation of the hydrophilic groups of the agents on the fibre determine the antistatic effect, and that antistatic agents function not only because they are hygroscopic and reduce fibre resistance, but because they are orientated in a specific manner on the fibre surface. The "ageing" of antistatic agents appears to be due to diffusion into the fibre, resulting in a reduced surface concentration and a correspondingly diminished antistatic effect; it is accompanied by an increase in the electrical surface resistance of the fibre. Antistatic agents reduce fibre resistance even at elevated temperatures and low atmospheric humidities.

Introduction

Static electrification was the earliest observed electrical phenomenon, and is as old and familiar as thunder and lightning. During the eighteenth century it was much investigated and passed through what has been termed a "shocking and crackling adolescence"¹. It acquired a reputation for capriciousness and erratic behaviour which still persists today, but with the discovery of current electricity, static electricity passed into a state of limbo which lasted until recent times.

In the textile industry static electrification must have occurred in the processing of wool and silk even in the remote past; yet it is only in recent years that it has become a major problem. In understanding why this should be so, a brief description of the cause of static may be helpful.

When any two surfaces, whether dissimilar or not, are brought or rubbed together, an electric charge is generated. For the charge to be readily detected one of the surfaces must be an insulator, otherwise the charge on it will rapidly leak away to earth. In textile processes such as spinning and weaving, where fibres move rapidly over each other and over the surfaces of guides and rollers, conditions are particularly favourable for the generation of static charges.

In the case of fibres of low electrical resistance, e.g. cotton and viscose rayon, the charges leak away rapidly to earth and, under normal conditions

of humidity, static is seldom troublesome. Only when the fibre is very dry, e.g. after calendering or a curing treatment, is static likely to be noticed.

The hydrophobic fibres, on the other hand, e.g. nylon, Terylene, the acrylics and cellulose acetate, are excellent insulators. Consequently, high electrical charges which cannot readily leak away are built up on their surfaces. This causes the individual fibres to fly apart, owing to mutual repulsion, and to adhere to any uncharged or oppositely charged object in the vicinity. It can thus be seen that static will lead to many processing difficulties, e.g. the production of irregular slivers and yarns and overall loss of output, so the control of static is a most important factor in relation to yarn quality.

The Control of Static Electrification

Static electrification of textiles may be controlled by various methods. These include—

- (1) The maintenance of high atmospheric humidity
- (2) A suitable arrangement of an external conductor in close proximity to the electrified material
- (3) Ionisation of the surrounding atmosphere by an electrical discharge or by means of radioactive materials
- (4) The use of antistatic agents or dressings.

MAINTENANCE OF HIGH HUMIDITIES

High atmospheric humidities increase the regain of the fibre and thus lower its electrical resistance, so any charge generated will rapidly leak away through the fibre to earth. It is noteworthy (a) that the charge leaks away largely through the fibre itself, and not through the moist air as is popularly supposed, and (b) that the electrical conductivity of moist air is lower than that of dry air. It is the effect of moisture content on the electrical conductivity of the fibre that is important.

For many textile applications, however, the high humidity necessary to eliminate static (75% R.H. or more) may be difficult to attain or unsuitable for the particular process, as well as being liable to cause rusting of the machinery.

THE USE OF EXTERNAL CONDUCTORS

Earthed bars, provided with sharp points and placed in close proximity to the fibre, will promote the gaseous discharge of the fibre. Fine wires or chains stretched across the surface of a fabric serve the same purpose. However, since a potential of 30,000 v. is required to cause a discharge across a 1-cm. gap of air at any humidity, this method is only suitable for limiting the charge on the fibre; it does not eliminate it completely.

IONISATION OF THE SURROUNDING AIR

If the air surrounding the charged material can be ionised, the ions will pass from the air to the fibre and neutralise those already on it. This may be accomplished either by employing radioactive substances or by using electric static-eliminators.

Radioactive eliminators utilise α - and β -ray emitters, but because of operator hazards the radioactivity level must be kept low, so they can only be used where movement is relatively slow, or for dissipating the static on a stationary object. An example is the well-known Shirley RASE unit, which employs ^{204}Tl as the ionising agent and is intended to prevent fog marking on looms.

The electric static-eliminators usually consist of a row of points connected to a source of at least 12,000 v., so that a silent electric discharge takes place from the points. Although effective, they are expensive and bulky and constitute a potential fire hazard. In addition, they generate ozone and nitric oxide², which many people find objectionable, and which can cause gas-fume fading. In common with earthed conductors and radioactive sources, they must be installed at every point where static build-up can occur.

ANTISTATIC AGENTS OR DRESSINGS

Certain classes of substances exert a pronounced antistatic effect when applied to textile fibres, the most generally useful being the surface-active agents. They provide the simplest and most economical method of controlling static electricity in the textile industry.

The mechanism by which antistatic agents function has not been established with certainty. It is known that they are hygroscopic and effectively reduce the electrical resistance of any

surfaces to which they may be applied, thus enabling any charge generated to leak away rapidly. They can also reverse the sign of the charge. They may promote the dissociation of any ionic materials present on the fibre, and it is probable that they modify the charging process itself.

Applications of Antistatic Agents in the Textile Industry

THE WOOLLEN AND WORSTED INDUSTRIES

Wool is an excellent insulator, but at 65% R.H. and above it seldom causes trouble from static, owing to its high moisture content and the presence of ionic impurities on the fibre. Below 55% R.H., however, serious difficulties are frequently encountered in carding, drawing and spinning. The web at the woollen or worsted card and the sliver in worsted drawing and spinning become electrified, resulting in lapping and the production of "fly".

Certain ethenoxy compounds containing long alkyl chains or alkaryl groups are excellent antistatic agents for wool, small amounts (0.15–0.5%) of these substances being capable of reducing the charge on the fibre to negligible proportions. Antistatic agents of this type may be incorporated in the oil prior to Noble combing, or they may be applied to the sliver from aqueous solution during the gilling operation by means of drip finger or roller devices. Satisfactory results have also been obtained in woollen carding by including antistatic agents in the carding oil.

Since antistatic agents of the fatty alcohol or alkylphenol-ethylene oxide condensate type are excellent detergents and emulsifiers, they also function as "scour-enhancing assistants" and facilitate removal of the combing oil during any subsequent scouring treatment.

Antistatic and Self-scouring Lubricants

The incorporation of antistatic agents in oils can cause certain difficulties in practice. With non-ionic compounds, although the antistatic effect tends to improve with increased ethylene oxide content, their oil-solubility decreases. Lissapol NX, for example, is insoluble in mineral oils, but it can be readily incorporated into oils if it is mixed with a compound containing a very short ethylene oxide chain, e.g. Lubrol MOA. A typical formulation is—

Oil	100 parts
Lissapol NX	15 parts
Lubrol MOA	10 parts

Water (1–2 parts) may be required to clarify the mixture.

Such lubricants are both antistatic and self-scouring, and are widely used in combing oils, as well as in the winding, coning and knitting of filament yarns of acetate or viscose rayon, nylon and Terylene.

POLYESTER, POLYAMIDE AND ACRYLIC FIBRES

These fibres are treated during manufacture with an antistatic dressing which is removed during dyeing or any other wet treatment. In order to avoid generation of static during subsequent

processing, replacement of the antistatic agent is necessary, this process always being the final wet treatment. Non-ionic antistatic agents of the Lubrol W or Dispersol VL type are widely used for this purpose, since they are easily applied and are unlikely to have any effect on the hue or fastness properties of dyes.

VISCOSE RAYON

Trouble due to static is seldom encountered with viscose rayon yarn or fabric, except when the humidity is abnormally low, and it is prevented by the presence of relatively low concentrations of antistatic agents.

Antistatic agents are frequently used in the processing of viscose rayon staple. By applying 0.3% of a fatty acid-ethylene oxide condensate, it has been found possible (a) to reduce fibre breaking during carding and minimise static during carding and drafting, (b) to reduce end-breaks during spinning, and (c) to increase yarn strength.

ACETATE RAYON

Acetate rayon is particularly prone to develop static charges and was probably the first synthetic fibre on which they were noticed. Any of the measures suggested for nylon and Terylene should prove effective. When a combined soft handle and antistatic effect is required, Cirrasol SB or Cirrasol AR may be used.

METHODS OF APPLICATION

The method of application will depend upon individual circumstances, but virtually any available technique, e.g. padding, spraying, or impregnation followed by hydroextraction, may be used. When dyeing is done in package form, it is convenient to circulate the solution through the package after the final rinse^{3,4}. Substantive antistatic lubricants such as Cirrasol HA have been developed for use in this way. They are particularly valuable for use on stock-dyed fibres, because they not only control static, but also reduce interfibre friction, so that subsequent processing is facilitated.

The Evaluation of Antistatic Agents

In evaluating antistatic agents, the test conditions must be standardised as carefully as possible; in particular, the atmospheric humidity must be accurately controlled. Other possible sources of erratic results—which cannot be disregarded but over which there is no convenient means of control—are the presence of ionising radiation, either from cosmic rays or from the walls and metallic surfaces of the room, and variations in the electrical conductivity of the air. The electrical conductivity of the atmosphere is a function of cosmic ray intensity, the rate of escape of radioactive radiation from the surface of the earth, and local air pollution. It is subject to diurnal and seasonal variations and may depend on local conditions, especially near large cities where atmospheric pollution is severe.

It is noteworthy that the electrical conductivity of foggy air is less than that of clear air, because

the ions tend to attach themselves to the comparatively large, slow-moving dirt particles and are thereby slowed down⁵. Thus the charge on a fibre will be conducted away by the atmosphere less readily in foggy weather than in clear weather, and the fibre will have a greater electrostatic attraction for dirt.

MEASUREMENTS ON FABRIC

The use of fabric for evaluating antistatic agents offers several advantages. Fabric is relatively easy to handle in comparison with yarn or loose fibre and the agent may be readily and uniformly applied by padding. Static measurements on fabric, therefore, provide a convenient method for the screening or selection of antistatic agents. The adoption of a number of standard treatments of known performance under mill conditions enables the results obtained on fabric to be correlated with performance on loose fibre, sliver or yarn with a sufficient degree of accuracy for routine purposes.

An instrument which is very suitable for the rapid testing of antistatic agents on fabric has been described by Hayek and Chromey⁶ and (in modified form) by Earnshaw⁷. It is illustrated in Fig. 1, whilst Fig. 2 shows a close-up of the rubbing arrangement.

The fabric under test is threaded through a series of slots on the circumference of a stainless steel drum which is rotated at ca. 270 r.p.m. by means of an electric motor. As the drum rotates it rubs against a standard rubbing surface, usually of Botany wool serge, which is held at constant pressure against it, with the result that the strip of fabric on the drum acquires a static charge. This is detected by a radio valve, the grid of which is in close proximity to, but not actually touching, the surface of the charged fabric, so that it functions as a probe electrode. Since the drum is rotating at 270 r.p.m. and there are 6 charged surfaces on it, the valve receives 27 pulses of electricity per second. The pulses are amplified and finally converted back into D.C. so that their magnitude can be measured with a valve voltmeter. Since the current produced in the detecting system by the charges on the fibre is in the form of D.C., which is somewhat inconvenient to amplify, the expedient of "chopping" is adopted, so that the current can be amplified and measured with comparatively simple apparatus.

The fabric is rubbed for 2 min., by which time the charge has built up to a maximum, and the reading on the voltmeter, which is calibrated in arbitrary units, is recorded. The rubbing surface is then removed and a note is made of the time taken for the charge to decay to half its maximum value. Decay times > 1 sec. are recorded as "1 sec.", no attempt being made to measure smaller time intervals.

An untreated fabric will develop a high charge and have a slow decay time, whilst a fabric treated with an antistatic agent develops a small or negligible charge which leaks away rapidly. A fabric can be considered static-free if the charge and decay time are not greater than about 200 units and 1 sec. respectively. Some typical results are shown in Table I.

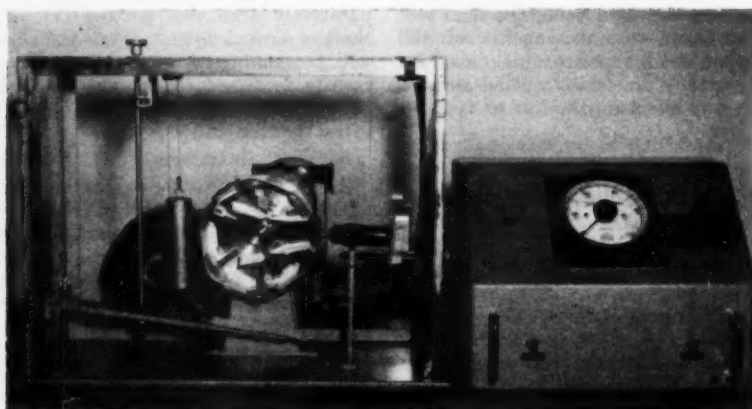


FIG. 1—Fabric Static Meter

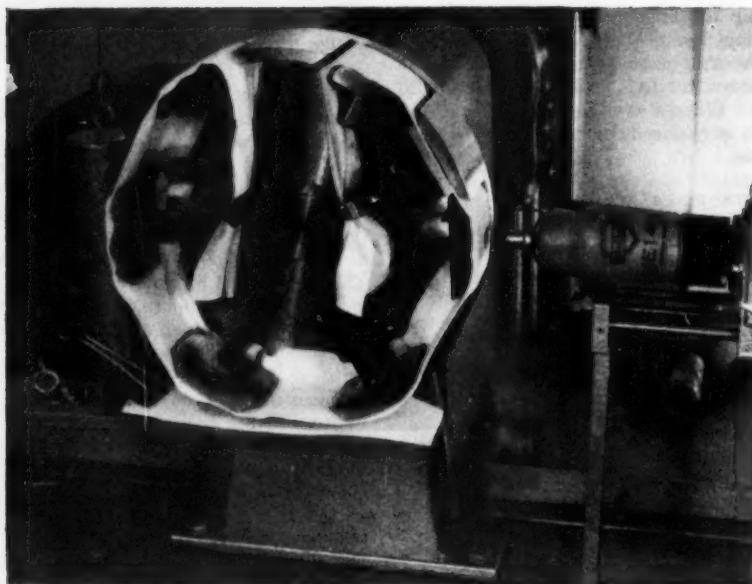


FIG. 2—Fabric Static Meter: Close-up of Rubbing Arrangement

TABLE I
Antistatic Effects on Nylon and Terylene Fabrics
(65% R.H. at 70°F.)

Fabric	Non-ionic Antistatic Agent used (% on wt. of fabric)	Charge (arbitrary units)	Half-life (sec.)
Nylon	0	1240	37
Nylon	0.2	120	1
Terylene	0	2200	130
Terylene	0.2	80	1

These results (and others in this paper) should not be interpreted as a comparison of the relative static propensities of nylon and Terylene, since the fabrics were of quite different construction.

Since all commercially available man-made fibres are treated with an antistatic finish before they are sold, this finish must be removed before the fabric is used for evaluating antistatic agents. A satisfactory procedure is a scour with soap and soda, followed by three or four thorough rinses in water at 60–80°C. It is advisable to avoid non-ionic detergents, since they are liable to impart an antistatic effect.

Desirable Characteristics of Processing Aids

Agents which perform well on the Fabric Static Meter are selected for more detailed and stringent evaluation. In addition to their antistatic effect, it is desirable that they should—

- (1) Not adversely affect processing performance
- (2) Be non-corrosive to metals and machinery
- (3) Provide adequate lubrication for the process for which they are intended
- (4) Be readily removed from the fibre by simple aqueous treatments
- (5) Not be subject to ageing
- (6) Function effectively at low humidities
- (7) Have no effect on the hue or fastness properties of dyes
- (8) Be in liquid form.

A perfect and universally applicable antistatic agent has yet to be discovered, and it is usual to select processing aids of this type on the basis of their suitability for a particular application.

SMALL-SCALE CARDING TRIALS

Some idea of processing performance can be gained by small-scale carding trials. Staple fibre, e.g. nylon or Terylene staple, is sprayed with a solution of the agent, dried and conditioned. It is then carded on the Shirley Miniature Card and the charge on the sliver is measured by the Faraday ice-pail method described by Keggins, Morris and Yuill⁸.

The charged sliver is run into a well-insulated pail or can connected to an electrometer, in parallel with which are suitable condensers that can be switched in to allow for a wide range of charges. When the sliver enters the can it becomes discharged and the potential of the system is measured by the electrometer. Since both the voltage and capacity of the system and the weight of the sliver in the can are known, the charge per g. of fibre can be calculated from the relationship—

$$\text{Quantity of electricity} = \text{Voltage} \times \text{Capacity} \\ (\text{in } \mu\text{C-coulombs}) \quad (\text{in } \mu\text{F-farads})$$

In addition to static measurements, the overall carding performance can be assessed, particularly any tendency to "card loading", which is the tendency of the fibre to bed down in the card clothing and choke up the card, and is particularly troublesome with the finer deniers. All known antistatic agents can cause loading if applied at sufficiently high concentrations, but some are worse in this respect than others. Card loading does not normally occur when static is present. In practice it is usually found that, as the concentration of antistatic agent is progressively increased, the charge on the fibre diminishes until finally it disappears completely. At this concentration there is little or no loading, but on further increasing the concentration, perhaps over a relatively wide range in the case of a good agent, the onset of loading becomes evident. Ultimately it can become so severe that carding is impossible.

MEASUREMENTS ON YARN

In the laboratory, antistatic properties may be tested by running the yarn over a suitable rubbing surface, e.g. an insulated metal peg connected to an electrometer. Alternatively, the charge on the yarn itself may be measured after rubbing. Electrostatic field meters such as that designed by Cross⁹ are very suitable for this purpose. Instruments of

this type are portable and so are very suitable for detecting the source of static trouble under a variety of works conditions.

RESISTANCE MEASUREMENTS

Modern man-made fibres and the acetate rayons have a very high electrical resistance, and so are prone to generate electrostatic charges. If their resistance could be reduced to that of cotton, then it is reasonable to assume that trouble from static would be minimised.

Resistance measurements on fibre assemblies require considerable care and specialised apparatus, since the values to be determined are very high indeed—frequently of the order of 10^3 to 10^6 megohms. Measurements can be made by winding 130 turns of yarn on to a former consisting of two screwed brass rods separated by polystyrene spacers. (Polystyrene is used because it has a very high resistance.) The 130 turns of yarn give 260 threads electrically in parallel, so the resistance of the complete assembly is 1/260th of that of a single thread, which renders measurement somewhat simpler. The yarn former is placed in a suitably humidified, screened enclosure and its resistance measured with a "20 million megohm-meter" (Electronic Instruments), which gives a direct reading of resistance in megohms. The yarn usually attains equilibrium with the atmosphere within 30 min.

Antistatic Action and Chemical Structure

Antistatic agents are hygroscopic and reduce the electrical resistance of fibres, and in the United States resistance measurements have been suggested as a means of evaluating antistatic agents. In order to determine whether these properties can be used to predict antistatic behaviour, three typical agents were selected for examination, viz.—

- (a) Lissapol NX, which is widely used as an antistatic agent
- (b) Polyethylene Glycol 300
- (c) Glycerol.

The last two compounds are both very hygroscopic.

HYGROSCOPICITY MEASUREMENTS

Before commencing the tests, the compounds were vacuum-distilled and then dried over phosphorus pentoxide.

The hygroscopicity, or moisture pick-up, measurements were made by exposing 3-g. samples in weighing bottles of 5 cm. diameter at different humidities. The desired humidity was obtained by placing the weighing bottles in desiccators containing saturated solutions of suitable salts, e.g. saturated lithium chloride gives ca. 15% R.H. and sodium nitrite gives 65% R.H. The samples were weighed at intervals until equilibrium with the atmosphere was attained; this usually took 9 days or less.

The results are illustrated in Fig. 3, which shows that Polyethylene Glycol 300 and glycerol are very much more hygroscopic than Lissapol NX. All the antistatic agents examined—both durable and

non-durable and of widely differing chemical types—absorb and desorb moisture until they are in equilibrium with the surrounding atmosphere.

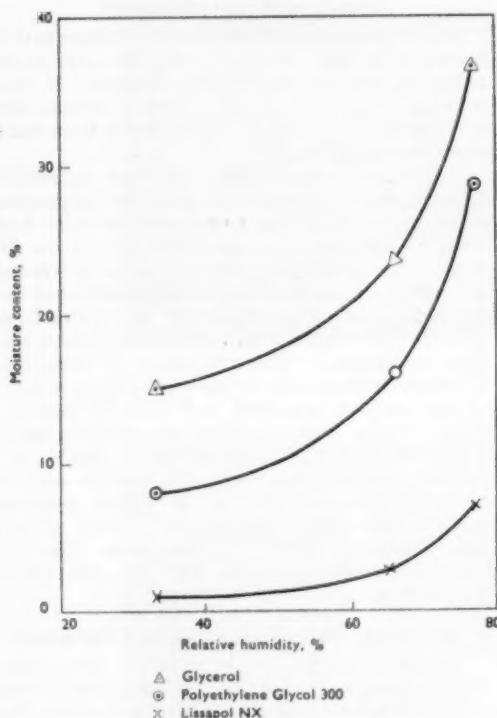


FIG. 3—Moisture Pick-up of Lissapol NX, Polyethylene Glycol 300, and Glycerol at Various Humidities at 70°F.

RESISTANCE MEASUREMENTS

Resistance measurements were made on nylon sewing thread treated with 0.1% and 0.2% of the agents. The yarn was extracted with ethanol before the treatment to remove any finish. The results are illustrated in Fig. 4.

It is seen that Lissapol NX and Polyethylene Glycol 300 are very much more effective than glycerol in reducing fibre-resistance, and that Lissapol NX is superior to Polyethylene Glycol 300 at very low humidities. The resistance of untreated yarn under these conditions was greater than 20×10^6 megohms and so was beyond the range of the instrument. In order to measure the resistance of untreated yarn under these conditions it is necessary to work at 75% R.H. or above.

SPECIFIC CONDUCTIVITY

Since it is considered that an antistatic agent forms a conducting path on the surface of the fibre, the specific conductivity of the agent itself may give an indication of its antistatic behaviour. The specific conductivities of Lissapol NX, Polyethylene Glycol 300 and glycerol, and of their aqueous and alkaline solutions, are given in Table II.

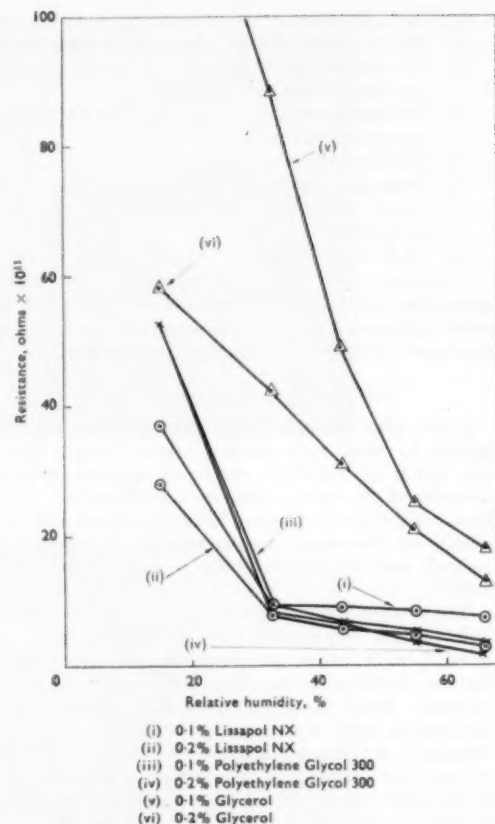


FIG. 4—Resistance Measurements at 70°F. on Nylon Yarn Treated with Lissapol NX, Polyethylene Glycol 300, and Glycerol

TABLE II

Specific Conductivity of Lissapol NX, Polyethylene Glycol 300, and Glycerol and of their Aqueous and Alkaline Solutions

Solution		Specific Conductivity k ($\text{ohm}^{-1} \text{cm}^{-1}$)		
Antistatic Agent (%)	Caustic Soda (%)	Lissapol NX	Polyethylene Glycol 300	Glycerol
0.2	0	7.1×10^{-4}	6.1×10^{-4}	6.3×10^{-4}
0.2	0.04	2×10^{-3}	1.4×10^{-3}	1.4×10^{-3}
50	0	6.2×10^{-3}	2.8×10^{-6}	1.9×10^{-4}
50	10	(Not compatible)	1.2×10^{-1}	1.6×10^{-1}
Anhydrous Agent		8.0×10^{-7}	4.6×10^{-3}	2.1×10^{-7}

The following values are given for comparison—

	k
Tap water	5.97×10^{-4}
Distilled water	3.3×10^{-6}
Sodium hydroxide (0.2%)	2.9×10^{-1}
Sodium hydroxide (10%)	2.5×10^{-1}

Probably the most significant feature of these results is that quite small amounts of alkali (ca. 0.04%) cause a very great increase in conductivity, and this factor can render resistance measurements valueless for comparing antistatic agents.

TABLE III

Static Measurements on Nylon Staple Fabric treated with Lissapol NX, Polyethylene Glycol 300 and Glycerol: Effect of Adding Caustic Soda

Agent	Concentration (% on wt. of fabric)	Antistatic Effect			
		66% R.H. at 69°F. Charge (arbitrary units)	Half-life (sec.)	33% R.H. at 70°F. Charge (arbitrary units)	Half-life (sec.)
None	0	880	55	810	163
Caustic soda	0.1	620	3	670	72
Lissapol NX	0.05	250	1	—	—
Lissapol NX	0.05	63	1	—	—
Caustic soda	0.1	—	—	—	—
Lissapol NX	0.1	140	1	65	1
Lissapol NX	0.1	58	1	45	1
Caustic soda	0.1	—	—	—	—
Polyethylene Glycol 300	0.05	800	101	—	—
Polyethylene Glycol 300	0.05	300	5	—	—
Caustic soda	0.1	—	—	—	—
Polyethylene Glycol 300	0.1	640	50	900	99
Polyethylene Glycol 300	0.1	900	9	820	34
Caustic soda	0.1	—	—	—	—
Glycerol	0.05	840	54	—	—
Glycerol	0.05	900	9	—	—
Caustic soda	0.1	—	—	—	—
Glycerol	0.1	780	48	800	111
Glycerol	0.1	620	6	860	75
Caustic soda	0.1	—	—	—	—

ANTISTATIC EFFECT

The agents were applied to nylon staple fabric by padding from aqueous solution. After drying and conditioning they were evaluated with the Fabric Static Meter. For this type of test the fabric must be conditioned at the appropriate humidity for at least 3 hr., and preferably overnight. The results are given in Table III.

Table III shows conclusively that glycerol and Polyethylene Glycol 300 are much inferior to Lissapol NX in antistatic behaviour. Addition of caustic soda improves the effect in all cases, but Lissapol NX is still superior to the remainder, particularly at 33% R.H.

Measurement of resistance has not been found to be a reliable method for the evaluation of commercial antistatic agents, because any ionic impurities present, due, for example, to residual catalysts used in their preparation, can cause significant changes in yarn resistance which are not necessarily reflected in an improved antistatic effect, and can completely swamp any changes due to chemical constitution.

In order to illustrate this point, the effect of adding caustic soda to the well-known antistatic agent, Lubrol W, was examined on two yarns of very similar denier, viz. 3/120s nylon and 3/125s Terylene. The caustic soda applied will be present on the fibre in the form of sodium carbonate, owing

to absorption of carbon dioxide from the atmosphere. Since caustic soda is much inferior in wetting power to Lubrol W, the treatments consisted in soaking the fibre at 50°C. for 15 min. before centrifuging. The resistance measurements given in Tables IV and V show that caustic soda, as expected, produces a marked increase in conductivity.

Two other effects are evident from Tables IV and V, viz.—

- (1) The resistance of the treated yarn increases as the humidity decreases. This is due not only to the decreasing moisture content of the fibre, but also to the decreasing moisture uptake of the antistatic agent on the surface of the fibre.
- (2) Although untreated Terylene is known to have a higher specific resistance than untreated nylon, i.e. it is a better insulator, the resistance of the treated Terylene is very much less than that of the treated nylon. The probable cause of this is discussed later in connection with "ageing".

Comparable antistatic measurements on Terylene fabric are given in Table VI. They indicate that the addition of caustic soda, contrary to what might have been expected from the resistance measurements in Table V, does not improve the antistatic properties of Lubrol W.

TABLE IV
Resistance Measurements (in ohms $\times 10^3$) on Nylon Sewing Thread:
Effect of Adding Caustic Soda

Lubrol W (% on wt. of fabric)	Caustic Soda (% on wt. of fabric)	Number of Days after Treatment					
		5	3	14	15	15	20
		65%	53%	43%	R.H.	33%	14%
0.1	0	4,050	16,500	26,000		65,000	100,000
0.1	0.005	3,000	11,750	23,750		62,000	125,000
0.1	0.05	355	1,570	4,350		13,500	35,500
0.1	0.5	13	54	820		3,725	13,200
0	0.005	15,500	87,500	> 200,000		> 200,000	> 200,000
0	0.05	3,840	18,600	79,000		> 200,000	> 200,000
0	0.5	240	880	3,975		> 200,000	> 200,000

TABLE V
Resistance Measurements (in ohms $\times 10^3$) on Terylene Sewing Thread:
Effect of Adding Caustic Soda

Lubrol W (% on wt. of fabric)	Caustic Soda (% on wt. of fabric)	Number of Days after Treatment					
		1	3	4	4	10	11
		65%	53%	43%	R.H.	33%	14%
0.1	0	0.325	1.19	4.65		14.8	280
0.1	0.005	0.24	1.09	4.85		18.3	305
0.1	0.05	0.16	0.32	1.2		3.3	135
0.1	0.5	0.08	0.23	1.2		4.75	130
0	0.005	550	520	7,950		18,500	120,000
0	0.05	325	11.15	61.5		133	14,000
0	0.5	0.355	1.3	37.5		98	7,500

TABLE VI
Antistatic Effect on Terylene: Addition of Caustic Soda to Lubrol W

Lubrol W (% on wt. of fabric)	Caustic Soda (% on wt. of fabric)	55% R.H.		33% R.H.	
		Charge (arbitrary units)	Half-life (sec.)	Charge (arbitrary units)	Half-life (sec.)
0	0	1,240	180	1,300	> 180
0.15	0	90	1	175	2
0.15	0.075	840	48	1,080	180
0.15	0.75	325	5	400	13
0	0.075	550	43	940	176
0	0.75	700	16	860	106

Tests, based on the addition of neutral electrolytes to antistatic agents, have given similar results, thus confirming that a hygroscopic material which lowers the electrical resistance of fibres does not necessarily confer a good antistatic effect. It has already been shown (Tables II and III) that, although glycerol and Polyethylene Glycol 300 are hygroscopic and increase fibre conductivity, they are ineffective at concentrations of the order of 0.1–0.2%, where commercial antistatic agents such as Lissapol NX or Lubrol W control static completely.

Measurements of resistance provide a useful method for evaluating compounds of known constitution and purity, but they should not be used as the sole basis for comparing commercial products. This view is confirmed by Edelstein and Teixeira¹⁰, who state that the lowering of a fabric's electrical resistance by various antistatic agents is no measure of their effectiveness. Further support is given by Polonik¹¹, who considers that there is no connection between the

resistivity of a fibre and its ability to be electrified, although the rate at which charges are dispersed depends entirely on the resistivity of the fibre.

The most effective antistatic agents for textiles are surface-active compounds, which are known to orientate themselves in a specific manner at interfaces. The author considers that antistatic agents function not only because they are hygroscopic and reduce fibre resistance, but also because of their orientation on the fibre.

The Ageing of Antistatic Agents

The term "ageing" is used to describe the gradual loss of antistatic effect with time. It is sometimes found that a sample of fibre which has been treated with an antistatic processing aid cards perfectly immediately after despatch from the factory, with complete absence of static, but, when the bulk of the fibre is processed months later, perhaps after being shipped to the tropics in the warm hold of a ship, it is virtually unmanageable.

TABLE VII
Heat Ageing of "Alcohol Phosphate" on Nylon (65% R.H. at 70°F.)

Experiment No.	Treatment	Antistatic Effect	
		Charge (arbitrary units)	Half-life (sec.)
(1)	Untreated	1340	48
(2)	Baked	1460	103
(3)	Treated with 0.3% "alcohol phosphate"	178	7
(4)	As (3), and baked	1120	63
(5)	As (3), baked, and extracted with water	1120	38
(6)	As (3), baked, extracted with water, and extract reapplied	200	7
(7)	As (3), baked, extracted with water, extract reapplied, and subjected to further heat ageing	680	35

"Heat ageing" is the term used to describe the loss of antistatic effect after a high-temperature heat treatment. Some synthetic fibres are subjected to high temperature in order to impart set or dimensional stability. If the antistatic agent is applied first, a loss of efficiency—which can be very marked with certain types of compounds—is usually noticed, so for this application it is usual to select the antistatic agent largely on the basis of its resistance to heat ageing. Heat ageing is a function of time and temperature and is very probably related to time ageing.

Most commercial antistatic agents, particularly those of the ethylene oxide condensate type, are very stable chemically and are unlikely to decompose or volatilise under the influence of heat. It is possible that, on heating, they re-orientate themselves on the fibre in such a manner that they no longer function as antistatic agents. Alternatively, they may diffuse into the fibre, thus reducing the concentration of agent on the surface, and hence the antistatic effect. Experiments with two chemically dissimilar compounds, using different techniques in each case, have shown that the concentration of agent on the fibre is unchanged after heat ageing. In the first experiment the antistatic agent (the diethanolamine salt of the acid phosphate ester of a long-chain fatty alcohol) was applied to nylon staple fabric, and the fabric heated in an oven at 150°C. for 30 min. This treatment is much more severe than any likely to be encountered in practice and was designed solely to

produce severe heat ageing. The fabric was then extracted in a Soxhlet for 7 hr. with water to remove any agent present, and the aqueous extract reapplied to the fabric. The antistatic effect was checked at each stage. The results are given in Table VII, from which it is seen that the antistatic effect is severely reduced after heating, but is restored after application of the extract, which obviously contained much or all of the agent on the fibre.

The second compound examined, Lissapol NX (an alkylphenol-ethylene oxide condensate), was chosen primarily because an accurate analytical technique existed for its estimation on the fibre. The ethenoxy compound is extracted from the fibre, precipitated with phosphomolybdic acid, redissolved, and estimated by ultraviolet analysis.

Scoured nylon and Terylene fabrics were padded in aqueous solutions of Lissapol NX covering a suitable range of concentrations. The patterns were dried, halved, and one-half of each pattern was heated at 150°C. for 30 min. The Lissapol NX content of the fibre before and after heating was then determined, and antistatic measurements were made. The results are summarised in Table VIII.

Again, a pronounced reduction in antistatic action is seen to occur after heating. The data for nylon show a fall in Lissapol NX content from 0.22% to 0.14% on heating, but the antistatic figures indicate that 0.14% Lissapol NX is adequate. The results with Terylene are similar. On the other hand, although nylon treated with

TABLE VIII
Heat Ageing of Lissapol NX on Nylon and Terylene

Calc. from Solution Concentration and Mangle Expression (%)	Concentration of Lissapol NX on Fabric By Analysis of the Fibre				Antistatic Effect			
	Before Heating		After Heating		Before Heating		After Heating	
	Methanol Extraction (hr.)	Lissapol NX found (%)	Methanol Extraction (hr.)	Lissapol NX found (%)	Charge (arbitrary units)	Half-life (sec.)	Charge (arbitrary units)	Half-life (sec.)
NYLON								
Untreated fabric	4	0	4	0	2,200	24	2,450	25
0.11	4	0.12	14	0.11	120	1	880	6
0.14	—	—	—	—	60	1	—	—
0.22	3.5	0.22	16	0.14	30	1	411	2
TERYLENE								
Untreated fabric	16	0	—	—	2,850	25	2,900	25
0.17	—	—	—	—	220	1	—	—
0.25	4	0.3	7	0.18	120	1	520	3
0.25	—	—	16	0.18	—	—	—	—

0.11% Lissapol NX shows no reduction in Lissapol NX content after baking, the fall in antistatic behaviour is most marked, and it is apparent that the substantial quantity of Lissapol NX remaining on the fibre is present in a state which prevents it from functioning effectively as an antistatic agent.

Heat ageing is usually more pronounced on nylon than on Terylene, whilst time ageing, according to Ward¹², is less noticeable with synthetic fibres which are difficult to dye, e.g. Dynel, Dacron and Orlon (in that order), than with nylon and acetate rayon.

Tables IV and V, which show the effect of Lubrol W and caustic soda on the resistance of nylon and Terylene yarns, are of interest in this connection. Although the specific resistance of untreated Terylene is higher than that of untreated nylon, the resistance of treated Terylene is actually lower than that of the corresponding treated nylon yarn. This is due to the agent diffusing less readily into the Terylene, so that a higher concentration is present on the fibre surface.

Complex molecules would be expected to show less ageing, and, in fact, durable antistatic agents, which are often based on polymeric compounds of high molecular weight, do not usually age. This fact, together with Ward's observations on dyeability, suggests that ageing is primarily due to diffusion of the agent into the fibre.

In practice, the conditions encountered in heat ageing are by no means as severe as those in the tests described, and both Lissapol NX and Lubrol W would remain effective after a conventional treatment.

EFFECT OF AGEING ON SURFACE AND VOLUME RESISTANCE

Surface Resistance

If heat ageing is due to diffusion of the agent from the surface of the fibre to the interior, it should be accompanied by an increase in surface resistance.

The surface resistance of a nylon disc fabricated from nylon sheet was determined by means of concentric brass electrodes, of 5 cm. and 7 cm. diameter respectively, which were screwed to the sheet. The area between the electrodes was then painted with a 0.05% solution of Lissapol NX and the resistance measured again. The disc, together with the untreated control, was next heated at 150°C. in an electric oven, and further measurements were made after conditioning for 24 hr. The results are summarised in Table IX.

TABLE IX

Surface Resistivity of Nylon: Effect of Heat Ageing (65% R.H. at 70°F.)

Duration of Heat Treatment at 150°C. (hr.)	Surface Resistivity (ohms $\times 10^9$)	
	Control (untreated)	Treated with Lissapol NX
0	187	5
1	280	187
2	280	187

The results show that heat ageing causes a marked increase in surface resistance.

Volume Resistance

Attempts were made to measure changes in volume resistance after heat ageing sheets or films of nylon, Terylene and cellulose acetate. The results obtained were erratic, doubtless owing to the inaccuracy associated with the measurement of very high resistances and the very pronounced changes in resistance which occur with very small changes in ambient temperature.

Behaviour of Antistatic Agents at High Temperatures

The conductivity of nylon and Terylene increases with temperature^{13,14}. Some recent work on Terylene has shown that its conductivity can be still further increased at high temperatures by applying antistatic agents, and that one agent (an esterified polyglycol) is almost as effective in this respect at 150°C. as at 20°C. This is an example of an agent reducing fibre resistance under conditions of extremely low ambient humidity, although there may have been traces of occluded moisture on the fibre itself. When the treated fibre was allowed to cool, its resistance rose to a value that was many times higher than during heating and, because of heat ageing, much higher than before the heat treatment.

Assuming that resistance measurements are significant under such conditions, it appears that antistatic agents can function even at high temperatures and very low humidities.

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(MS. received 3rd March 1960)

References

- Hunt, F. V., *Electronacoustics* (New York: John Wiley, 1954).
- Loeb, L., *Static Electricity* (Berlin: Springer-Verlag, 1958).
- Sagar, H., *J. Textile Inst.*, **45**, p. 206 (1954).
- Henshall, A. E., *Tintoria*, **52**, 316 (1955).
- Chalmers, J. A., *Atmospheric Electricity* (London: Pergamon Press, 1957).
- Hayek, M., and Chromey, F. C., *Amer. Dyestuff Rep.*, **40**, 164 (1951).
- Earnshaw, J., *Hexagon Digest*, No. 22, 28 (1955).
- Keggin, J. F., Morris, G., and Yuill, A. M., *J. Textile Inst.*, **40**, T 702 (1949).
- Cross, A. S., *British J. Appl. Phys.*, Supplement No. 2, s 47 (1953).
- Edelstein, S. M., and Teixeira, N. A., *Amer. Dyestuff Rep.*, **43**, 195 (1954).
- Polonik, P. A., *Elektrichestvo* (8), 17 (1958).
- Ward, G., *Amer. Dyestuff Rep.*, **44**, 220 (1955).
- Baker, W. O., and Yager, W. A., *J. Amer. Chem. Soc.*, **64**, 2176 (1942).
- Amborski, L. E., and Burton, R. L., *Electrical Manufacturing*, **53**, 124 (1954).

Discussion

HUDDERSFIELD SECTION

Mr. H. SELLERS: What recommendations can be made for overcoming the considerable trouble experienced with dry cloths?

Mr. HENSHALL: The most satisfactory procedure is to treat the cloth with 0.1–0.2% Lissapol NX or Lubrol W.

Mr. W. WOOD: Have static charges been observed in high-temperature dyeing machines where the air is under pressure?

Mr. HENSHALL: I have not encountered this phenomenon, but it might well occur, owing to the electrification of droplets or spray. It has been known for over a hundred years that, when wet steam is blown through a nozzle, electric charges are generated, and Armstrong, in an investigation of this effect using a suitably insulated boiler, obtained sparks 22 in. long (see W. Fordham Cooper, "The Electrification of Fluids in Motion", *British J. Appl. Phys.*, Supplement No. 2, s 14 (1953)).

Mr. C. PARKER: Are non-ionic agents likely to upset silicone finishes, and does running water remove them?

Mr. HENSHALL: The presence of any antistatic agent in appreciable quantity on the fibre adversely affects water-repellency, but non-ionic compounds, because of their superior wetting power, are the worst in this respect. The fibre should not be exposed to acid conditions when treated with a non-ionic compound, since this causes increased adsorption of the agent by the fibre. Provided that this precaution is taken, no difficulty should be encountered in rinsing them off the fibre. Antistatic agents are widely used as additives to combing oils and, if the fabric is rinsed well before dyeing, no adverse effect on water-repellency should be encountered.

Mr. M. SHAW: Does the amount of antistatic agent required depend on the weight of the fabric?

Mr. HENSHALL: In general, heavy fabrics require a higher concentration than light-weight cloths.

Mr. F. JORDINSON: How can "fly" be reduced with blanket wools?

Mr. HENSHALL: Fly is commonly caused by static electricity; it can be reduced by means of a suitable antistatic agent, e.g. Lissapol N.

Mr. I. GILL: Are the American antistatic agents resistant to washing with synthetic detergents?

Mr. HENSHALL: Commercially available, durable antistatic agents are based on resinous materials with hydrophilic constituents, e.g. polyethylene glycols or quaternary compounds. They are resistant to washing with soap, sulphated fatty

alcohols of the Lissapol C type, or non-ionic preparations such as Lissapol N or Stergene. When the fabric is washed with alkyl aryl sulphonates, which are widely used in modern washing powders, a marked reduction in antistatic effect occurs, but can be counteracted by a brief treatment in soap solution—this is believed to be due to metathesis between the antistatic agent and the stearate radical.

Mr. R. L. ROBINSON: I have noticed more fly than is usual, and a greater tendency to static charges, on worsted slubbing dyed to light depths with metal-complex dyes.

Mr. HENSHALL: This is quite a common effect, and can be caused by variations in the conductivity of the combing oil on the wool due to the presence of the dye and ionic impurities. The conductivity tends to increase with the depth of dyeing, with a corresponding reduction in static charge.

Mr. M. NUTTON: Is there any relationship between antistatic agents and anti-soiling products?

Mr. HENSHALL: Surfaces at a comparatively low potential, e.g. 100–150 volts, became dirty in the course of time. Although the presence of an antistatic agent prevents a charge from building up on a fabric, the majority of dirt particles are themselves electrified, either positively or negatively, so they will still be attracted to the fabric and adhere to it and soil it. If the antistatic agent imparts a sticky handle to the fibre surface, this may further encourage the retention of the dirt particles. There is now considerable evidence to indicate that currently available antistatic agents, both durable and non-durable, do not prevent soiling and may even contribute to it. An antistatic agent of the Lissapol N type, however, because of its detergent properties, will facilitate removal of the soil during subsequent washing.

Mr. L. G. BATTYE: I am surprised that antistatic agents do not impart anti-soil properties in view of the widespread use of products such as Cirrasol AR.

Mr. HENSHALL: Although Cirrasol AR is an effective antistatic agent, its anti-soiling properties are due primarily to its molecular constitution, as a result of which the product minimises oil-wicking, imparts a smooth surface to the fibre, and reduces the adhesion of dirt.

Paper Chromatography of Synthetic Dyes

J. C. BROWN

Meetings of the West Riding Section held at the Griffin Hotel, Leeds, on 11th February 1960, Mr. J. Rankin in the chair; of the Scottish Section held at the St. Enoch Hotel, Glasgow, on 23rd February 1960, Mr. J. G. B. McCallum in the chair; of the Leeds Junior Branch held at The University, Leeds, on 1st March 1960, Mr. B. C. Burdett in the chair; of the Huddersfield Section held jointly with the Huddersfield Section of the Royal Institute of Chemistry at Silvio's Café, Huddersfield, on 8th March 1960, Mr. G. H. Binns in the chair; and of the Scottish Junior Branch held at the Paisley Technical College on 16th March 1960, Mr. C. McNeil in the chair

The general techniques of paper chromatography are outlined and specific examples of suitable methods for disperse, acid, direct and metal-complex dyes are given. Methods of extracting dyes from various textile fibres are given. The complex nature of many commercial dyes is discussed in relation to methods of manufacture.

Introduction

The word "chromatography" was coined to describe a particular technique, used originally in the study of carotenoids and other plant pigments¹, which resulted in the production of coloured bands of separated pigments on a column of adsorbent. The precise mechanism of this process defied definition in physico-chemical terms, and in many cases it still does so today.

Dye identification becomes more and more difficult as the number of available dyes increases, and the recognition of paper chromatography as a powerful analytical technique should stimulate greater interest in its adoption in this field.

COLUMN CHROMATOGRAPHY AND PAPER CHROMATOGRAPHY

The following are the main types of chromatography (ignoring the field of gas chromatography), and there are examples of each in both paper and column techniques—

- (1) Classical or adsorption chromatography
- (2) Partition chromatography²
- (3) Ion-exchange chromatography.

In adsorption chromatography, a column of alumina may be used as the adsorbent and an

organic liquid as the mobile phase or eluent. The strength of the molecular attachment of the substances being examined determines their relative rates of travel down the column. Certain types of paper chromatography, particularly those using aqueous mixtures, have essentially the same mechanism.

With partition chromatography, the solid adsorbent is replaced by a stationary liquid phase adsorbed on a solid supporting medium. The rate at which a substance travels down the column or paper is dependent on its partition between the stationary liquid and the eluent. Many separations on paper are considered to be of this type, the cellulose acting as a support for an aqueous phase over which a non-aqueous eluent is allowed to flow.

With the third type, ion-exchange chromatography, the substance being examined is held on the adsorbent by ionic linkages and can be displaced by other ions of a similar charge, provided that they have greater affinity for the adsorbent. As well as ion-exchange resins in powder form for column work, ion-exchange papers are available.

GENERAL TECHNIQUES OF PAPER CHROMATOGRAPHY

Fig. 1 illustrates diagrammatically two methods of producing paper chromatograms using sheets of paper. The apparatus is totally enclosed in a large glass tank covered by a flat plate resting on a ground flat surface (see Fig. 2). In the method illustrated on the left of Fig. 1, the paper is allowed to hang from a glass rod by suitable stainless steel clips, and the bottom of the sheet dips into the eluent liquid in the bottom of the tank. This produces an ascending chromatogram. In the other case the paper is held in a glass trough by means of a heavy glass rod, passes over another glass rod and then hangs down into the tank. The eluent is placed in the glass trough and, flowing down the paper, produces a descending chromatogram. All the examples to be discussed in this paper use one or other of these two techniques, but there are many variations in the way in which the paper can be

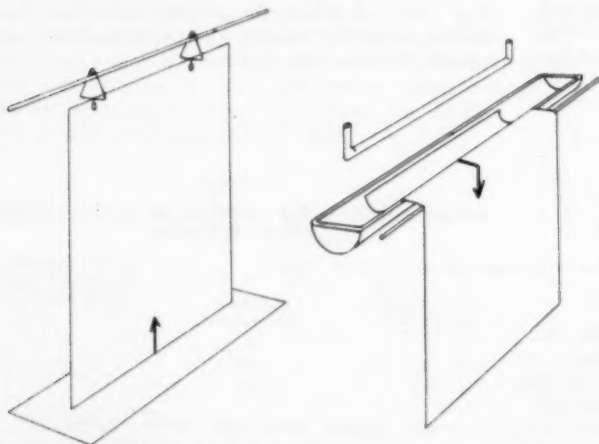


FIG. 1—Production of Ascending and Descending Chromatograms

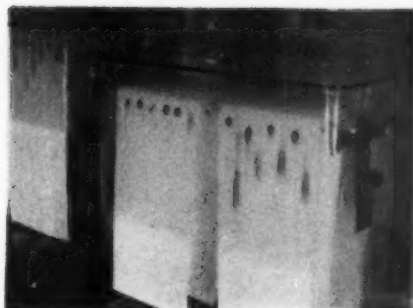


FIG. 2—Simultaneous Descending Partition Chromatography on a Large Number of Samples

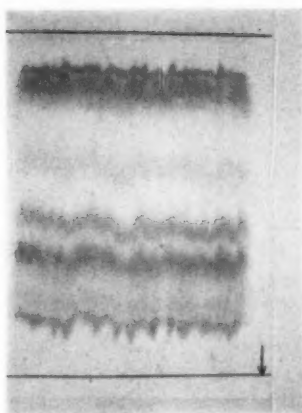


FIG. 13—Commercial Brown Disperse Dye Mixture (Disperse System No. 3)

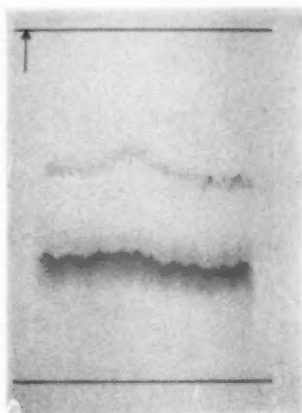


FIG. 16—Extract from Viscose Carpeting Material (Direct System No. 1)



FIG. 17—C.I. Direct Red No. 45 (Direct System No. 1)

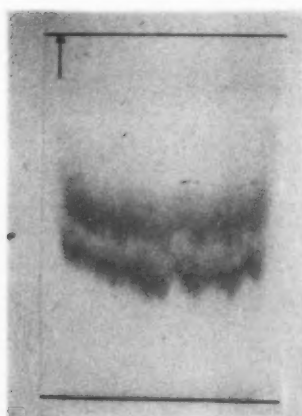


FIG. 28—Mixed Co-ordination 2:1 Metal-complex Dye (Metal-complex System No. 1)

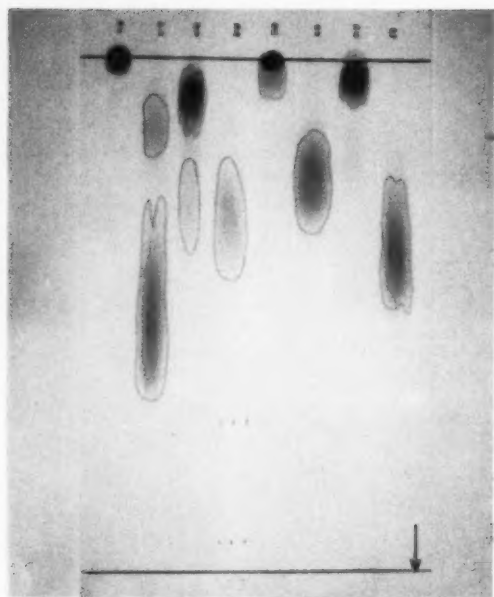


FIG. 5—Red Disperse Dyes (Disperse System No. 1)

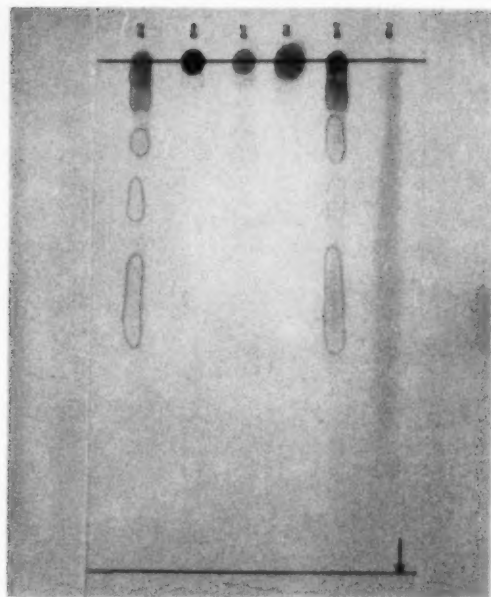


FIG. 6—Blue Anthraquinonoid Disperse Dyes
(Disperse System No. 1)

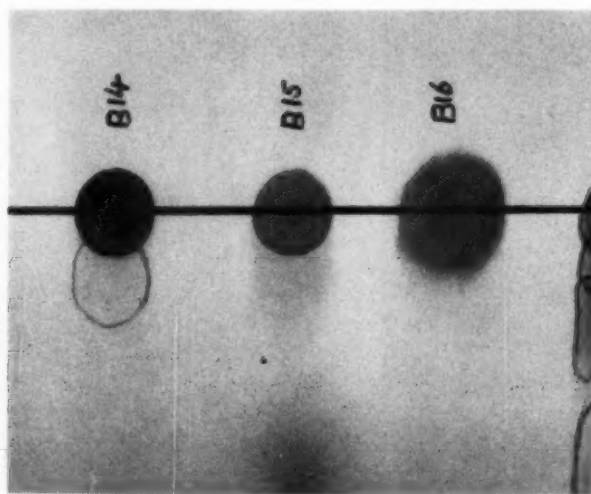


FIG. 7—Enlargement of Fig. 6

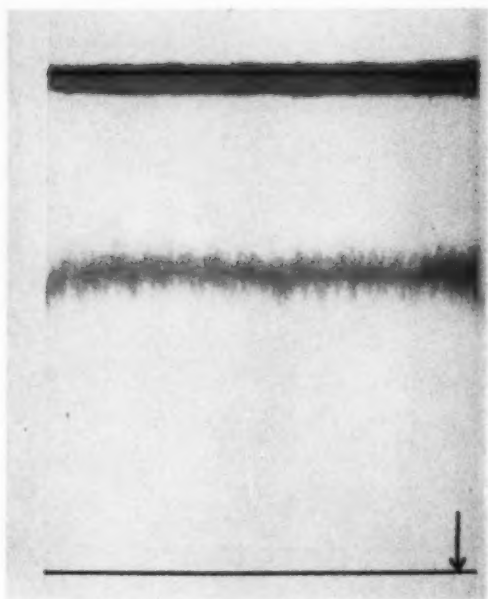


FIG. 9—Separation of Two Forms of C.I. Disperse Orange 5 (one elution)

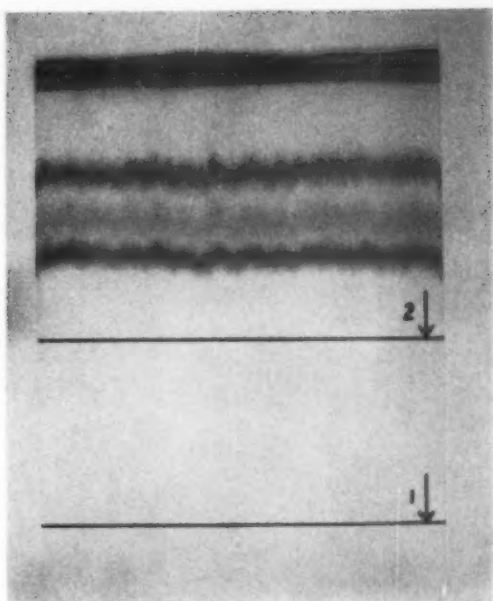


FIG. 10—Separation of Two Forms of C.I. Disperse Orange 5 (two elutions)

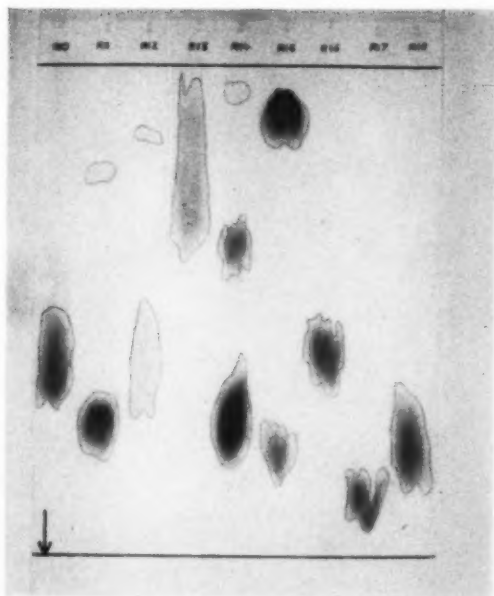


FIG. 11—Red Disperse Dyes (Disperse System No. 3)

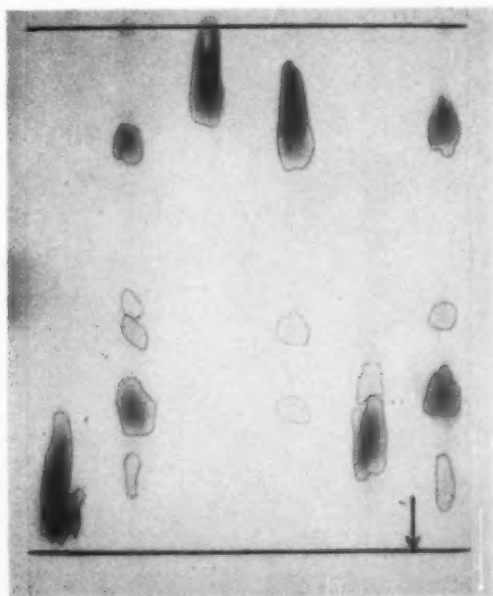


FIG. 12—Blue Anthraquinonoid Disperse Dyes (Disperse System No. 3)

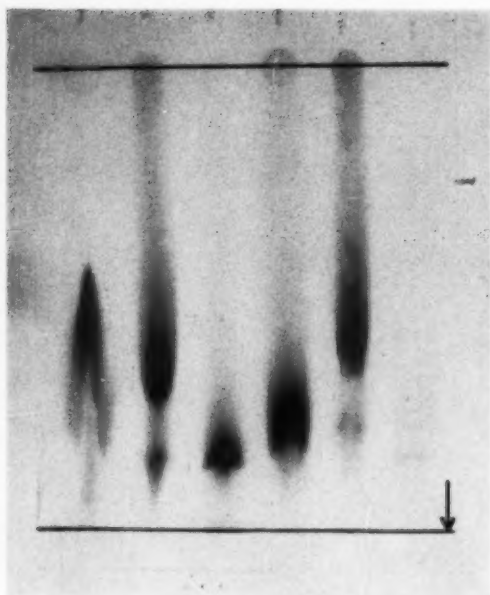


FIG. 14— Direct Dyes

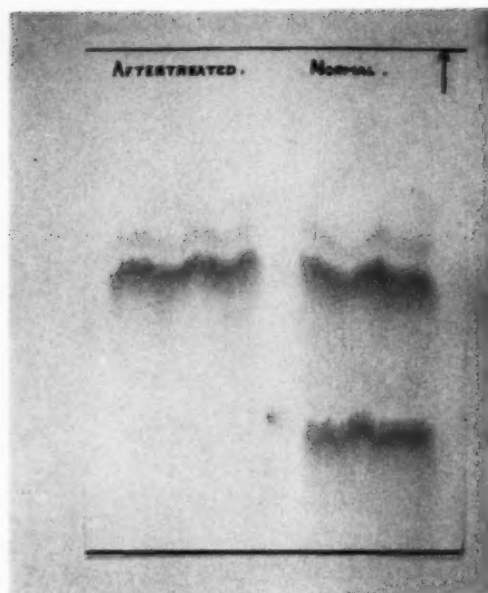


FIG. 20— Effect of Cationic Fixing Agents
(Direct System No. 1)

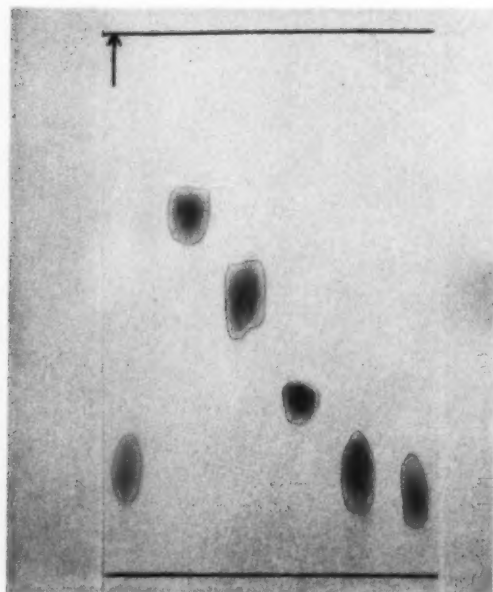


FIG. 21— Foodstuff Dyes (Acid System No. 1)



FIG. 22— Acid Dyes (Acid System No. 2)

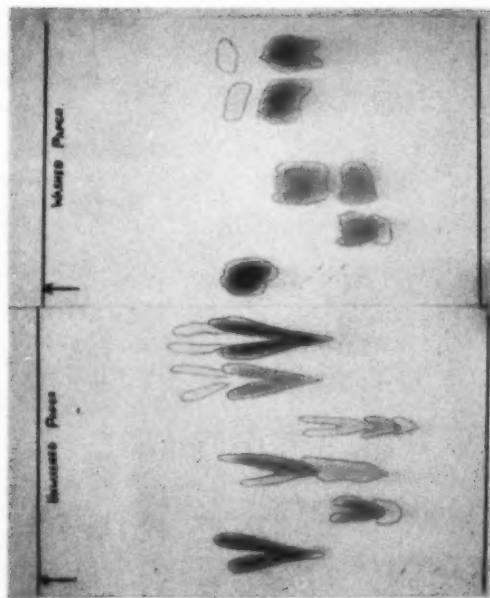


FIG. 15—Washed and Unwashed Paper (Direct System No. 1)



Original dyeings



After boiling for 2 min. with 2:1 dimethylformamide-water

FIG. 19—Removal of Direct Dyes from Cotton

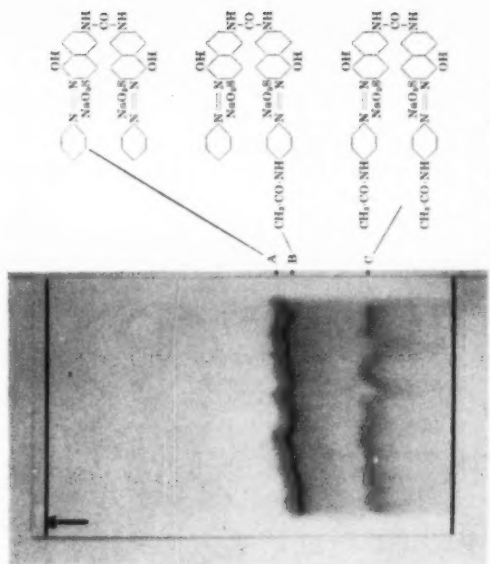


FIG. 18—C.I. Direct Red 23 (Direct System No. 1)

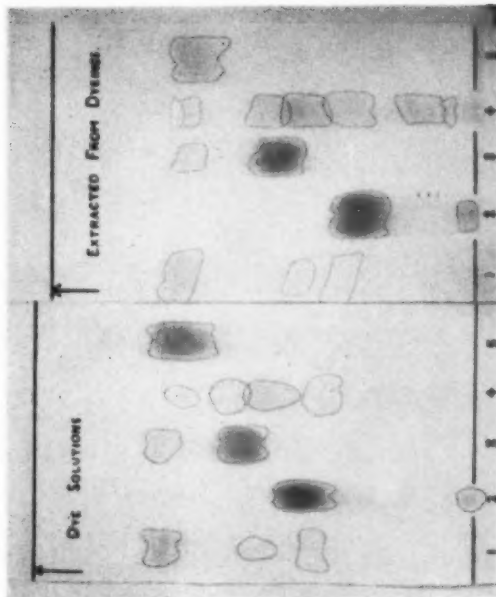


FIG. 20—Acid Dyes Extracted from Wool (Acid System No. 2)

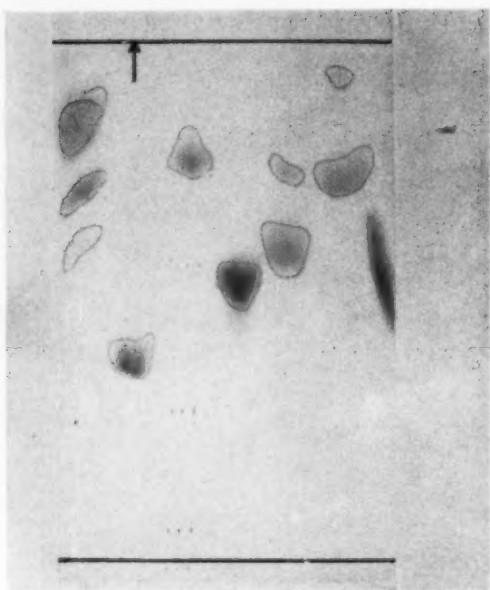


FIG. 23— Acid Dyes (Direct System No. 1)

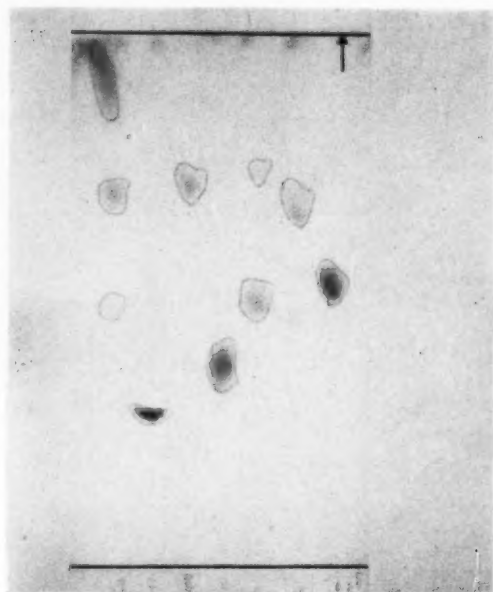


FIG. 24— Acid Dyes (Acid System No. 3)



FIG. 25— Acid Dyes (Acid System No. 3; Whatman AE30 paper)



FIG. 27— 2:1 Metal-complex Dyes (Metal-complex System No. 1)

manipulated, the underlying principles and the results obtained being very similar. There are several reviews of general chromatographic techniques^{2,3}.

The substances to be examined are applied as a spot, or as a band across the width of the paper, either by a fine capillary pipette which permits the application of known quantities, or by using a loop of platinum wire which can easily be cleaned by insertion into a Bunsen flame. The paper is then dried before commencing chromatography.

Apart from some obvious general considerations, the choice of paper is arbitrary and there are very many different grades, even from the same manufacturer. There is a considerable variation in the velocity of travel of the eluent with different papers. Thicker papers enable larger amounts to be chromatographed, thus improving the visibility of the spots. Extensive comparative work on different papers applied to amino-acid chromatography has been published⁴. The solvents employed must be reasonably pure, but notable improvement can rarely be achieved by using rigorously purified solvents.

R_f VALUES AND IDENTIFICATION

The literature on chromatography is full of references to the " R_f value", which is simply (see Fig. 3) the ratio of the distance travelled by the spot or band to the distance travelled by the front of the eluent⁵. In theory, and very occasionally in practice, this is a constant—for one chemical entity under one particular set of conditions—which is independent of the amount of development of the chromatogram. Experience suggests that too much emphasis can be laid on the R_f value, and it is unwise to use it as a criterion of identification without further evidence. Identification should rest on comparative chromatograms against known dyes and, where possible, chemical tests on the spots obtained. Assuming a suitable eluent system to be available, the practical difficulties associated with the actual chromatography of the dyes are few and easily overcome, but difficulties may arise in the extraction of dyes from textile fibres. This point is discussed in more detail when considering each individual class of dyes. Prolonged boiling to concentrate the extract may destroy some dyes, and it is necessary to evaporate the solvent under reduced pressure. The apparatus illustrated in Fig. 4 is simple and effective, but more elaborate apparatus is available*. Vacuum should be supplied by an efficient mechanical pump giving a pressure of 1 cm. of mercury or less, rather than a water filter-pump, and evaporation is continued until the dye concentration is in the range 1–10 g./litre.

Disperse Dyes

Work on disperse dyes published in this *Journal* by Elliott and Telesz⁵ and by Johnson and Telesz⁶, and elsewhere by Zahn⁷ and by Janousek⁸, has shown that paper chromatography can be very useful for separating and identifying these dyes.

* For example, the rotary vacuum evaporator marketed by J. W. Towers & Co. Ltd., Widnes, Lancs.

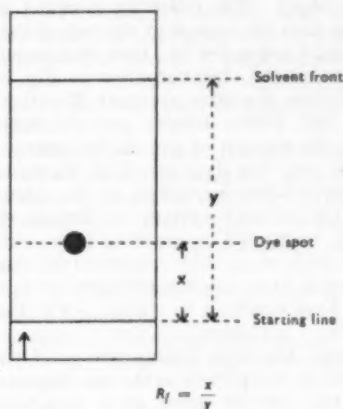


FIG. 3—The R_f value

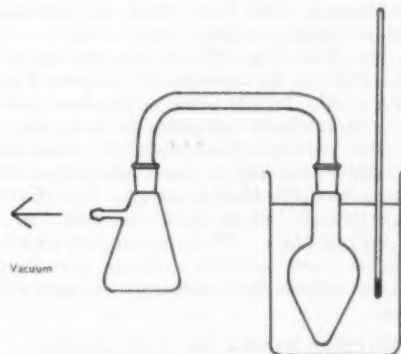


FIG. 4—Evaporation under Reduced Pressure

The methods used by the present author differ from those adopted by other workers, but it is not proposed to discuss the relative merits of the different techniques.

DISPERSE SYSTEM NO. 1 (PARTITION)

Fig. 5 illustrates a chromatogram of a random selection of red disperse dyes subjected to descending partition chromatography with the following eluent mixture—

Cyclohexane	200 ml.
Glacial acetic acid	192 ml.
Water	8 ml.

This quantity (400 ml.) and those given subsequently are suitable for use in a chromatography tank of size 20 in. (high) \times 12 in. \times 7 in. The eluent mixture is shaken, allowed to stand in a separating funnel, and the bottom layer run off into the chromatography tank. The paper (usually Whatman No. 1), which has previously been spotted with the dyes to be examined, is placed in the tank ready for descending chromatography and the whole is allowed to come to equilibrium overnight. The paper hangs above the liquid in the bottom of the tank, but does not touch it. A layer of concentrated acetic acid solution, in equilibrium with cyclohexane, is built

up on the paper. The following morning the top layer is run into the trough at the top of the tank. Elution, which takes 4-6 hr., then commences.

The spots on the chromatogram in Fig. 5 are a little too diffuse to enable accurate R_f values to be obtained, but better results are obtainable by decreasing the amount of dye on the paper. With this system very few dyes give high R_f values, the R_f value invariably increasing as the amount of water in the solvent system is decreased—the proportion suggested represents the minimum consistent with reasonable temperature stability. It is desirable that the temperature of the room should be kept constant to within $\pm 2^\circ\text{C}$. throughout the whole operation.

In general, the blue anthraquinonoid dyes do not separate as completely as the azo disperse dyes, although this system gives good separations in many cases. Fig. 6 illustrates a chromatogram of some blue disperse dyes, and Fig. 7 is an enlarged portion showing some dyes which, on first inspection, do not appear to have "run" at all.

Dye No. B14 (Fig. 7) has not moved at all. Dye No. B15 has an appreciable R_f value; but the solubility in the mobile phase is too low, and the result is a faint streak extending down the paper to the position corresponding to the R_f value, and a diffuse edge at the top of the original spot where the eluent has dissolved it away. Dye No. B16 has an extremely low R_f value (ca. 0.01), but has moved very slightly. These examples, which are common to most partition systems, may help to provide distinguishing features in seemingly doubtful cases.

DISPERSE SYSTEM NO. 2 (PARTITION)

The following eluent mixture also gives good results with azo disperse dyes—

Cyclohexane	200 ml.
Formic acid (98-100%)	150 ml.
Water	50 ml.

and is not so sensitive to temperature changes as the mixture incorporating acetic acid. The procedure is identical to that outlined above.

Fig. 8 illustrates variations in R_f value, obtained by varying the composition of this mixture, for three orange azo disperse dyes, one of which can exist in two forms and gives two spots. In Fig. 8, x represents parts of water in 100 parts formic acid-water mixture per 100 parts cyclohexane.

It is noteworthy that dyes No. 2 and No. 3b do not separate with certain mixtures, but are readily separated with others. Dyes No. 1 and No. 3a only "run" over part of the range of possible solvent combinations, the R_f values being zero for other combinations. Dye No. 3 could be mistaken for a mixture of two orange dyes, but changing the eluent composition also changes the relative intensity of the two spots, thus indicating interconvertibility of the two forms. As the amount of water is increased to 100 parts of water per 100 parts of cyclohexane, form b decreases in intensity and eventually becomes too faint to be detected. Using Disperse System No. 1, only one clearly-defined spot (R_f value 0.3) is obtained, and there is no indication of a second component.

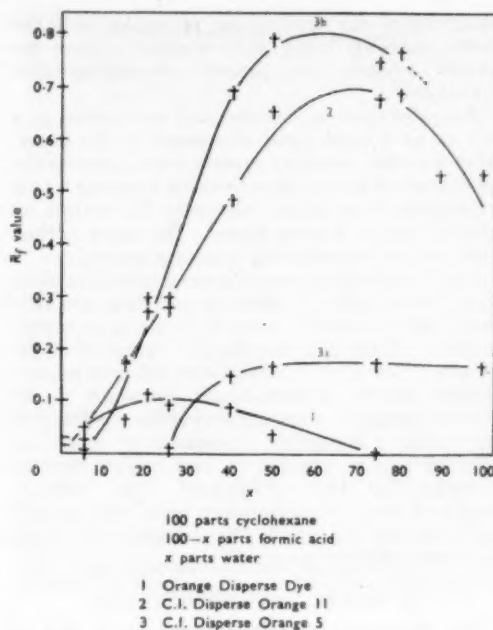
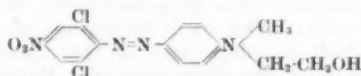


Fig. 8—Variation of R_f Value with Eluent Composition

Dye No. 3 has the structure—



and the observed results are best explained on the basis of separation of *cis*- and *trans*-isomers, the relative stability of which may be influenced by the preponderance of electron-attracting groups in the *o*- and *p*-positions of the diazo component.

Fig. 9 shows the separation of a wide band of the same dye applied by means of a fine pipette across the whole width of the paper. Immediately one form is separated from the other, they both tend to produce the original equilibrium proportions, and the paper behind the faster-moving orange band is, in fact, very slightly tinted orange.

If the chromatogram is developed as far as possible, the faster-moving band becomes noticeably weaker. Fig. 10 shows the result obtained if the chromatogram is stopped at this point, dried in an air-oven and restarted the following day. The two bands shown in Fig. 9 have each reverted to an equilibrium mixture, and further elution produces a total of four bands. The author is unaware of the separation of any other dye into *cis*- and *trans*-isomers by this means, but Frankel and Wolovsky⁹ have separated *cis*- and *trans*-azobenzene by paper chromatography.

DISPERSE SYSTEM NO. 3 (INVERSE PHASE PARTITION)

Disperse Systems No. 1 and No. 2 both employ a stationary hydrophilic phase on the paper, the eluent being a hydrophobic liquid. The reverse

procedure is possible, using a stationary hydrophobic phase, and this is usually termed *reverse phase partition chromatography*. A silicone-treated paper* which facilitates this technique is now available, and the procedure is very similar to that employed with the other systems. The following eluent mixture is used—

Chloroform	200 ml.
Glacial acetic acid	200 ml.
Water	200 ml.

The mixture is shaken and allowed to stand. After separation, the heavier chloroform layer is run into the bottom of the tank, where it is allowed to stand with the paper overnight; the aqueous layer is then used as the eluent.

Fig. 11 illustrates separations for an arbitrary selection of red disperse dyes, all of which give good chromatograms. The method is also valuable for the blue anthraquinonoid disperse dyes (Fig. 12).

Fig. 13 illustrates the application of Disperse System No. 3 to a commercially brown disperse dye and clearly indicates its complicated nature. At least one of the deliberate components of this mixture (the blue dye) is itself a mixture and gives three bands.

A variation of this system can be employed with some success using 200 parts of chloroform, 200 parts of methylated spirits and 120 parts of water. Obviously, many other possibilities exist which have not been explored by the author, and it may be possible to discover even better eluents.

DISPERSE SYSTEM NO. 4 (ADSORPTION)

The following eluent mixture, for ascending chromatography, also gives good separations in many cases—

Cyclohexane	150 ml.
Dimethylaniline	50 ml.

This is very well worth trying if the other systems do not provide a sufficiently good separation.

REMOVAL OF DISPERSE DYES FROM FIBRES

Table I gives the different solvents which are recommended for removing disperse dyes from some synthetic fibres.

TABLE I

Fibre	Extraction Solvent	Additional Information
Secondary acetate	Methylene chloride	Place between filter circles in a Buchner funnel, pour and re-pour solvent through until extraction is complete
Triacetate	80% Acetone	
Nylon	Dimethylformamide	Bring to the boil in a test-tube. The dye is removed rapidly. Cool immediately
Terylene		
Courtelle	50% Formic acid	Boil, cool, dilute with an equal volume of cold water, add excess ammonia, cool, and extract with chloroform. Some dyes are destroyed or modified
Acrilan		
Orlon		

* Supplied by H. Reeve Angel & Co. Ltd., 9 Bridewell Place, London, E.C.4.

Secondary cellulose acetate and cellulose triacetate must be extracted in the cold with the recommended solvents. Unless the procedure outlined above is followed, the material will curl and fold upon itself, making the extraction much more difficult.

Difficulties may be encountered when extracting nylon with dimethylformamide, as some types of nylon have appreciable solubility in this solvent. In this case, the extract should be evaporated to dryness and the dye redissolved in methyl ethyl ketone.

Extraction from acrylonitrile fibre is much more difficult, as the dyes are held by the acidic groups in the fibre. The somewhat drastic treatment necessary for extraction limits the usefulness of the method.

Direct Dyes

Direct dyes have long been regarded as not amenable to paper chromatography because of their high affinity for cellulose, owing to hydrogen-bond formation¹⁰. Most of the previous attempts at chromatography have used pyridine mixtures, the pyridine presumably competing with the cellulose in forming hydrogen bonds.

Some work has been carried out on the chromatography of reduction products of direct dyes¹¹, but this method of approach becomes too complicated when applied to even the simplest of mixtures.

Mixtures of pyridine with water and other solvents at various pH values have been tried with a representative selection of direct dyes, but results are obtained similar to that illustrated in Fig. 14. The dyes merely resolve into streaks down the paper, and in some cases travel with a steadily decreasing velocity and finally become permanently anchored to the paper.

A complicated eluent mixture described by Sramek¹² is based on pyridine and methylated spirits, but this has not proved very satisfactory.

DIRECT SYSTEM NO. 1 (ADSORPTION)

Another powerful solvent which probably owes its potency to a capacity to form hydrogen bonds is dimethylformamide*, and the following eluent mixture has been found very effective for direct dyes—

Benzyl alcohol	90 ml.
Dimethylformamide	60 ml.
Water	60 ml.

It is used ascending the paper in a straightforward manner. Owing, however, to the ability of dimethylformamide to dissolve impurities from the paper itself, which results in poor chromatograms, a little preparatory work is necessary.

Fig. 15 shows, side by side, two chromatograms of a random selection of direct dyes, both developed by Direct System No. 1. That on the left was carried out on ordinary Whatman No. 1 paper, that on the right on Whatman No. 1 paper previously washed with the following mixture—

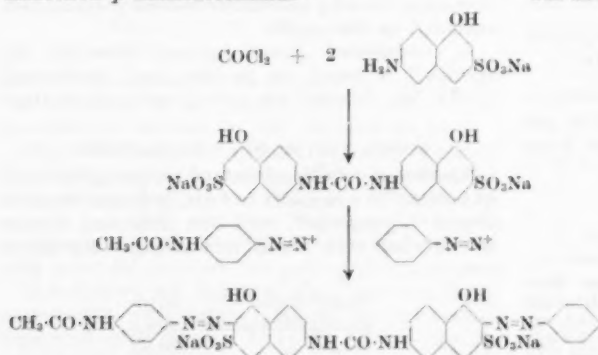
* Toxic, acute local irritant.

Benzyl alcohol	100 ml.
Dimethylformamide	100 ml.
Methyl ethyl ketone	100 ml.
Water	100 ml.

Washing is carried out overnight in a chromatography tank in the manner of descending chromatography, the liquid being allowed to drip off the bottom of the sheets. The paper is then dried in an air-oven at 60–80°C. for 1 hr. before spotting with the dyes to be examined. It is obvious (Fig. 15) that much improved chromatograms are obtained by this pretreatment of the paper.

Fig. 16 illustrates the use of this system with a mixture of direct dyes extracted from a sample of viscose rayon carpeting material. The method of extraction will be discussed later. By subsequent comparison of chemical spot-tests on this chromatogram and on standard dyes having approximately the same R_f value, it was found possible to identify all the dyes used in this mixture. A further aid to identification may sometimes be found in the ultraviolet fluorescence of the chromatograms. In the case of direct dyes this is usually very faint, but may still be characteristic. A very few dyes are highly fluorescent, e.g. C.I. Direct Red 45, which is illustrated in Fig. 17. This chromatogram also shows colourless fluorescent bands which are due to impurities produced during manufacture.

The method of manufacture may readily explain the complicated chromatograms given by many dyes of this class, which are often mixtures of related compounds. For example, C.I. Direct Red 23 is made by treating phosgene with 6-amino-1-naphthol-3-sulphonic acid, the product being coupled with a mixture of diazobenzene and diazotised *p*-aminoacetanilide—



The resulting product is not homogeneous, only a certain proportion having the formula given in the *Colour Index*. A mixture of three components is formed (Fig. 18), some molecules (A) having a phenyl residue and others (C) an acetanilido group at both ends. The component with a phenyl residue at both ends is another common orange direct dye (C.I. Direct Orange 26). Other direct dyes in common use are even more complicated, but it is found in practice that this complexity is often an aid to identification rather than a hindrance.

REMOVAL OF DIRECT DYES FROM CELLULOSIC FIBRES

Chromatographic identification must be preceded by fairly efficient extraction of the dyes from the fibre, and the most effective stripping agent so far discovered for the majority of dyes is a mixture of 2 parts of dimethylformamide and 1 part of water; pure dimethylformamide is not as effective. The approximate efficiency of stripping of a random selection of direct dyes from cotton cloth is indicated by Fig. 19. Small pieces of the dyeings were boiled vigorously in a test-tube for ca. 2 min., when practically all the dye passed into the liquid. The samples were then rinsed quickly and dried. The extracted dye solution is concentrated before application to the chromatography paper, and this should be carried out under reduced pressure. During evaporation, the water is removed first, the boiling point rising continuously to that of pure dimethylformamide (152.8°C. at 1 atm.).

Concentration of the solution at atmospheric pressure is too severe for some direct dyes and they may be destroyed, so in these cases it is essential to carry out the evaporation under reduced pressure.

EFFECT OF CATIONIC AFTERTREATMENTS

The limited wet fastness of many direct dyes on cellulose has led to the use of cationic fixing agents, which introduces a serious complication in chromatographic identification. Fig. 20 illustrates a chromatogram of a commercial dyeing of a combination of two direct dyes before and after treatment with a cationic fixing agent. Aqueous dimethylformamide strips one dye from the material with equal facility in the presence or absence of the fixing agent, whereas the other dye will not strip at all if the material has been after-

treated. This is a serious drawback which—at least as far as the red direct dyes are concerned—affects about one-third of the dyes in common use. A satisfactory universal method has yet to be found for removing this type of fixing agent without affecting the dye.

EFFECT OF METALLIC AFTERTREATMENTS

It is common practice to improve the fastness of direct dyes by after-treatment with copper salts, and this also may complicate extraction and subsequent chromatography. Preliminary

work on this problem suggests that many dyes lose combined copper and are indistinguishable from untreated dyes after chromatography. Some dyes, however, retain the metal, and from the point of view of chromatography these dyes require further investigation.

Acid Dyes

For many years acid dyes were the only class to which chromatography was applied. A large proportion of the published work on dye chromatography is concerned with acid dyes, mainly in connection with the identification of synthetic

colouring matters in foodstuffs¹³⁻³⁴. Some of these papers are of value to those interested in dyes for textile application^{24,29,30}, and there are other papers which refer more specifically to textile dyes^{7,35-40}. In the dyeing industry, work is frequently carried out by means of capillary attraction, as described by Midgelow⁴⁰, the method being in regular use for identifying quite complex mixtures of acid dyes. No special chromatographic apparatus is used and the paper is usually open to the atmosphere, i.e. no attempt is made to work in an atmosphere saturated with the solvent. Consequently, water is the usual eluent, and under these conditions only the level-dyeing acid dyes give good separations.

ACID SYSTEM NO. 1 (ADSORPTION)

The number of possible solvent combinations suitable for the chromatography of acid dyes is very large, and it is not intended to discuss the merits of the many recipes to be found in the literature. The following eluent mixture has the merit of being very simple and is effective in many cases—

Methylated spirits	160 ml.
Water	40 ml.

Fig. 21 illustrates a chromatogram of a selection of dyes permitted for use in foodstuffs in this country. Similar results are obtained with other mixtures of ethanol (or methanol) and water which have been suggested.

ACID SYSTEM NO. 2 (ADSORPTION)

The following eluent mixture, due to Thaler and Sommer³⁰, is very effective (Fig. 22) and is capable of giving well-defined spots—

1-Butanol	125 ml.
Absolute alcohol	24 ml.
Water	53.5 ml.
Ammonia (0.880)	1.5 ml.

The small amount of ammonia present is thought to be responsible for better definition of the spots. Anhydrous methylated spirits may be employed in place of absolute alcohol, but the above proportions should be reproduced exactly, as this composition is rather critical.

ACID SYSTEM NO. 3 (ADSORPTION)

The following variation on Direct System No. 1, using proportionally greater quantities of benzyl alcohol, is also very useful for acid dyes—

Benzyl alcohol	200 ml.
Dimethylformamide	100 ml.
Water	100 ml.

The R_f values of acid dyes with Direct System No. 1 are invariably high (Fig. 23), but the same dyes with Acid System No. 3 show a better distribution (Fig. 24). With this system the paper must be washed and dried before use, in the manner described for direct dyes.

Other solvent mixtures which give good results are those using 1-butanol or *t*-butyl alcohol in various proportions with pyridine and water^{24, 36}, and those based on ethylene glycol or isobutyric acid^{7, 38}.

ION-EXCHANGE CHROMATOGRAPHY

The advent of ion-exchange papers* has brought new possibilities to paper chromatography. These papers are manufactured from cellulose containing additional groupings of different chemical type, so the number of possible adsorption mechanisms is very considerably increased. Ionic interaction can take place between the substrate and the substance being examined, and it is possible to use eluents containing other ions which compete for the available sites on the paper. Some success has already been achieved with these papers in the chromatography of metallic cations⁴¹.

The presence of basic groups in the cellulose has a profound effect on the R_f values of acid dyes (Fig. 25), the affinity of the dye for the paper increasing to such an extent that, in some cases, migration no longer takes place. The paper employed here is Whatman AE 30, which is amino-ethylcellulose, and the dyes in Fig. 24 and 25 are identical. Although in some cases a more complete separation can be achieved, the use of this paper does not immediately offer new possibilities in the identification of acid dyes. Another ion-exchange paper, Whatman DE 20, has been found useful for the chromatography of 2:1 metal-complex dyes, and this will be discussed later.

Metal-complex dyes containing sulphonic groups behave like ordinary acid dyes as far as chromatography is concerned.

REMOVAL OF ACID DYES FROM WOOL

Substantial amounts of most acid dyes can be stripped from wool by using a 10% (vol./vol.) solution of ammonia (0.880) at the boil. The extract can be evaporated down to a suitable volume and the solubility of the dye increased, if necessary, by adding a drop of 1% sodium carbonate solution. Fig. 26 illustrates two chromatograms using Acid System No. 2, one of extracts from dyeings taken from normal bulk production, and the other of solutions made up to the same recipes. Although the R_f values do not correspond exactly, there is a close resemblance between the two chromatograms. In the case of dyeing No. 4, extra spots are obtained with the extract, which may indicate some decomposition of the dyes during extraction or subsequent evaporation.

2:1 Metal-complex Dyes

METAL-COMPLEX SYSTEM NO. 1

These important dyes can be chromatographed with the aid of Whatman DE 20 paper (diethyl-aminoethylcellulose) and the following eluent—

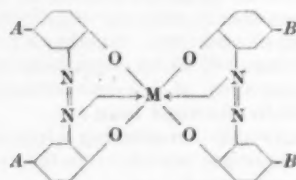
1-Butanol	150 ml.
Formic acid (98-100%)	30 ml.
Water	60 ml.

A straightforward ascending technique is employed the only complication being a tendency of this mixture to esterify slowly. This results in the separation during chromatography of another phase which may rise a little way up the paper, but it does not travel sufficiently far to interfere

* H. Reeve Angel & Co. Ltd., 9 Bridewell Place, London, E.C.4.

with the normal development of the chromatogram. Well-defined and well-separated spots are usually obtained, although care should be taken to avoid overloading the paper with dye.

Fig. 27 shows some of the more widely employed 2:1 metal-complex dyes, and it is seen that some of them contain more than one component. No explanation can be offered for the mixed nature of one of these dyes which gives seven clearly defined spots, but among the others there are two giving three clearly defined spots which can be readily explained. In these cases the centre spot is exactly the colour obtained on dyeing and the two spots on either side when mixed together also give this colour. The explanation lies in the structure of the co-ordination complex itself. These dyes are all 2:1 metal-complexes, i.e. two dye molecules are co-ordinated with one metal atom. It is also possible to produce mixed complexes by co-ordinating two dissimilar molecules with the same atom, to give compounds of the type—



where *A* and *B* are dissimilar substituents. Both dye molecules are co-ordinated simultaneously with the metal (*M*), and it is inevitable that some symmetrical molecules will be formed in which all four substituents are either *A* or *B*. It is not unreasonable to expect that the colour of the unsymmetrical dye will approximate very closely to that of a mixture of the two symmetrical dyes (Fig. 28).

REMOVAL OF 2:1 METAL-COMPLEX DYES FROM WOOL

2:1 Metal-complex dyes can be stripped completely from wool by treatment with a 2:1 mixture of dimethylformamide and water, on a boiling-water bath for as long as is necessary, e.g. 15–30 min. The resulting extract can be concentrated and spotted on Whatman DE 20 paper and compared directly with solutions of known dyes.

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(MS. received 25th April 1960)

References

- Tawett, M., *Trav. soc. nat. Varsovie*, **14** (1903); *Ber. dtsh. botan. Ges.*, **24**, 316, 384 (1906); *Biochem. Z.*, **5**, 6 (1907); *Chromofilli w rastitelnom i schivotnom mirje* (Warsaw, 1910).
- Martin, A. J. P., and Syngé, R. L. M., *Biochem. J.*, **35**, 1358 (1941).
- Lederer, E., and Lederer, M., *Chromatography* (London: Elsevier, 2nd edition, 1957).
- Cassidy, H. G., *Fundamentals of Chromatography*, Vol. X of "Technique of Organic Chemistry" (London: Interscience, 1957).
- Kowkabany, G. N., and Cassidy, H. G., *Anal. Chem.*, **22**, 817 (1950).
- Elliott, K., and Telesz, L. A., *J.S.D.C.*, **73**, 8 (1957).
- Johnson, C. D., and Telesz, L. A., *ibid.*, **74**, 858 (1958).
- Zahn, H., *Textil Praxis*, **6**, 127 (1951).
- Janousek, J., *Textil*, **12** (3), 107 (1957); *J.S.D.C.*, **73**, 328 (1957).
- Frankel, M., and Wolovsky, R., *Experientia*, **10**, 367 (1954).
- Vickerstaff, T., *The Physical Chemistry of Dyeing* (London: Oliver & Boyd, 2nd edition, 1954), p. 180.
- Kitahara, S., and Hiayama, H., *J. Chem. Soc. Japan* (Ind. Chem. Section), **58**, 620 (1955); *Chem. Abs.*, **50** (10), 7463 (1956).
- Sramek, J., *Textil*, **13** (9), 346 (1958).
- Serini, G., *Chimica* (Milan), **34**, 95, 144, 197 (1958); *Chem. Abs.*, **52** (22), 20712 (1958).
- Puche, R. C. T., *Rev. Assoc. Bioquim. Arg.*, **22**, 228 (1937); *Chem. Abs.*, **52** (13), 11303 (1958).
- Calvo, J. M., *Anales Bromatol* (Madrid), **9**, 423 (1957); *Chem. Abs.*, **52** (11), 9461 (1958).
- De Gori, R., and Cantagalli, P., *Boll. Chim. Lab. Provinciali* (Bologna), **8**, 23 (1957); *Chem. Abs.*, **51** (22), 18361 (1957).
- Maccio, I., *Anales Direc. Nacl. Quim.* (Buenos Aires), **9** (17), 10 (1956); *Chem. Abs.*, **52** (11), 9461 (1958).
- Delfina, J. M. P., and Macian, R. S., *Galenica Acta* (Madrid), **9**, 243 (1956); *Chem. Abs.*, **51** (21), 17104 (1957).
- Venturini, A., and Zanoni, L., *Boll. Chim. Lab. Provinciali* (Bologna), **7**, 16 (1956); *Chem. Abs.*, **50** (22), 17223 (1956).
- Valenciano, O. A., and Ibarra, A., *Rev. Assoc. Bioquim. Arg.*, **21**, 141 (1956); *Chem. Abs.*, **51** (10), 7221 (1957).
- Dehusses, J., and Desbaumes, P., *Mitt. Lebensm. Hyg.*, **47**, 15 (1956); *Chem. Abs.*, **50** (17), 12341 (1956).
- Sclar, R. N., and Freeman, K. A., *J. Assocn. Off. Agric. Chem.*, **38**, 786 (1955).
- Valenciano, O. A., and Ibarra, A., *Rev. Assoc. Bioquim. Arg.*, **20**, 145 (1955); *Chem. Abs.*, **50** (2), 731 (1956).
- Fujii, S., *Bull. Natl. Hyg. Lab. Tokyo*, **73**, 335 (1955); *Chem. Abs.*, **50** (10), 7014 (1956).
- Tilden, D. H., *J. Assocn. Off. Agric. Chem.*, **37**, 812 (1954).
- McKeown, G. G., *ibid.*, **37**, 527 (1954).
- Kludes, K. H., *Chem. Tech.* (Berlin), **6**, 39 (1954); *Chem. Abs.*, **48** (11), 6326 (1954).
- Monseles, J. J., and Miranda, D., *Inds. agri. et aliment.* (Paris), **71**, 223 (1954); *Chem. Abs.*, **48** (16), 9581 (1954).
- Mitchell, L. C., *J. Assocn. Off. Agric. Chem.*, **36**, 943 (1953).
- Thaler, H., and Sommer, G., *Z. Lebensm.-Untersuch. und -Forsch.*, **97**, 345 (1953); *Chem. Abs.*, **48** (4), 2376 (1954).
- Sclar, R. N., *J. Assocn. Off. Agric. Chem.*, **36**, 930 (1953).
- Tilden, D. H., *ibid.*, **36**, 802 (1953).
- Idem, *ibid.*, **35**, 423 (1952).
- Siedlecka, J., *Roczniki Panstwowego Zakładu Hig.*, **2**, 33 (1951); *Chem. Abs.*, **49** (14), 9032 (1955).
- Kolsek, J., *Chem.-Ztg.*, **82**, 35, 457 (1958).
- Zollinger, H., and Stamm, O. A., *Helv. Chim. Acta*, **40**, 1105 (1957).
- Dobas, J., *Chem. Listy*, **51**, 1202 (1957); *Chem. Abs.*, **51** (15), 11720 (1957).
- Kacprzak, F., and Olszewski, Z., *Przem. Chem.*, **11**, 677 (1955); *Anal. Abs.*, **4** (2), A 591 (1957).
- Yokoyama, M., and Matsubara, S., *Ann. Proc. Gifu Coll. Pharm.*, **4**, 55 (1954); *Chem. Abs.*, **50** (17), 12483 (1956).
- Midgelow, G. W., *Hexagon Digest*, No. 3, 3 (1948).
- Knight, C. S., *Nature*, **183**, 165 (1959).

COMMUNICATION

The Effect of Solvents in Wool Dyeing

L. PETERS, C. B. STEVENS, J. BUDDING, B. C. BURDETT, and J. A. W. SYKES

In order to study the mechanism of solvent-assisted wool dyeing, using benzyl alcohol as the solvent, measurements have been made of (a) the sorption of the solvent from aqueous solution by wool, (b) the solubility of the solvent, and (c) its effect on the surface tension of water at different temperatures. The heats and entropies of sorption, surface formation and solution are consistent with the hypothesis that the sorption of benzyl alcohol by wool most probably consists merely of physical adsorption on the inter-micellar surfaces in the fibre.

Increased swelling of the wool fibres in aqueous solutions of the solvent is not apparent, and the accelerated rate of dyeing is shown to depend on the affinity of the dye for the solvent, as measured by the partition ratio of dye in the solvent to dye in the water. The solvent lowers the activation heat barrier, but increases the activation entropy barrier: whether it accelerates or retards dyeing depends on which is affected to the greater extent.

INTRODUCTION

Since the observation¹ that addition of certain sparingly water-soluble solvents to aqueous dye-baths produces a marked increase in the rate of uptake by wool of certain types of dyes, a considerable amount of work has been carried out to establish the mechanism of the process and to evaluate its technological importance^{2,3}.

From these results, and from experimental bulk dyeing, first carried out at the works of Messrs. Strachan & Co. Ltd. of Stroud, practical methods for dyeing loose wool, slubbing and yarn have been developed by the Geigy Co. Ltd., as described by Beal, Bellhouse, and Dickinson⁴. It appears that completely satisfactory results can be obtained, using conventional machinery and procedures, by dyeing for as short a time as 30 min. at 70–80°C., using a wide range of neutral-dyeing metal-complex dyes or selected fast-to-milling acid dyes with benzyl alcohol as the solvent. A further observation by the present authors was that addition to the dyebath of cationic agents, e.g. quaternary alkyl ammonium or pyridinium compounds, reduced the hydrophilic character of polysulphonated dyes, thus promoting the uptake of dyes which otherwise do not respond to the presence of the solvent.

These effects in aqueous dyebaths indicated that a similar increase in the rate of uptake of dyes by slubbing and cloth would be found from thickened pastes containing solvents⁵.

Delmenico⁶ subsequently investigated the effect of adding benzyl alcohol to mélange printing pastes, whilst Beal *et al.*⁴ have reported the effect of adding the same solvent to printing pastes used in screen and roller printing on wool. Their results confirm those of the present authors, viz. that there is a great increase in the rate of fixation of dye. Chlorination to increase the rate of fixation of dye is therefore unnecessary, and we have found that steaming times as short as 4 min., using saturated steam at atmospheric pressure, are sufficient to produce the depth of colour, penetration and fastness required.

A quantitative study⁷ of the uptake of dye by cloth from printing pastes containing benzyl alcohol has confirmed that the rate of fixation of Carbolan Brilliant Blue 2R (ICI) or a typical

neutral-dyeing metal-complex dye is greatly increased when amounts of solvent up to 12% (on wt. of paste) are added. Experiments in which benzyl alcohol was replaced by ethyl alcohol proved that this is not due simply to the increase in wetting power of the paste containing the solvent.

An obvious advantage of any dyeing process which can be completed in a shorter time and at a lower temperature than is normally required is that damage to the material will be less. Roth⁸ compared the effect on wool of dyeing with Irgalan Grey BL (C.I. Acid Black 58) in presence of benzyl alcohol, with that of conventional dyeing at the boil. He found a definite improvement in spinning quality when dyeing took place at the lower temperature. Yarn from wool dyed with Eriochrome Black T (C.I. Mordant Black 11) and afterchromed—each for 15 min. at 60°C. in presence of benzyl alcohol—was commercially satisfactory and approximately 20% stronger than that from wool treated similarly in the absence of solvent.

Oldfield⁹ studied the effect on yarn strength of conventional dyeing methods using acid, strongly acid-dyeing metal-complex, and neutral-dyeing metal-complex dyes, as well as the effect of dyeing with neutral-dyeing metal-complex dyes at 60°C. in presence of 8% (vol./vol.) *n*-butyl alcohol. The reduction in yarn strength after dyeing at 60°C. in presence of this solvent was found to be lower than with any conventional procedure at the boil. He also examined the effect on the elastic properties of single wool fibres of treating them in the *n*-butyl alcohol–water dyebath, and found that the maximum reduction in work required to stretch them 30% did not exceed 6%, even after treatment for 16 hr. at 60°C. Similarly, Elliott¹⁰ found that the reduction in work required to stretch single fibres in distilled water after treatment in 3% (vol./vol.) benzyl alcohol at 60°C. for 2 hr. was 3.5%. The corresponding figure for treatment in distilled water was 2.5%, whilst for treatment in the solvent–water dyebath in presence of 2% (on wt. of material) of Irgalan Grey BL it was 4.0%. These data indicate that, at 60°C., the magnitude of any irreversible effect on wool keratin of the solvent in the treating solution is very small. Swelling has been invoked to explain the greater ease of stretching of fibres in solvent solutions, and

this might appear to support the theory that the increase in dyeing rate observed in presence of solvents is due to increased swelling; yet when wool has been so treated and then washed thoroughly, its dyeing behaviour reverts to that of the original untreated wool.

Mechanism of Solvent-assisted Dyeing

Various mechanisms have been postulated to account for the effect of adding sparingly water-soluble solvents to aqueous dyebaths containing selected dyes. It has been suggested¹¹ that addition of solvents capable of breaking hydrogen bonds promotes breakdown of dye micelles, even at room temperature, thus permitting ready entry of dye into the fibre. A further suggestion¹² is that solvent is adsorbed at the surface of the fibre to give a layer in which the dye is more soluble than it is in water. Hence there is preferential partition, leading to an increase in concentration of dye at the fibre surface and, consequently, a steeper diffusion gradient. This building up of a dye-rich surface layer leads to a higher rate of absorption than from simple aqueous solutions. Yet another suggestion is that the solvent acts as a "carrier" by promoting reversible modification of the fibres by which it is adsorbed, leading to increased swelling and thus more rapid diffusion of dye. Experimental evidence so far available is inconclusive, and it is not yet possible to say whether any of the mechanisms put forward are operating.

The results presented in this paper include data on (a) the partition of selected dyes between benzyl alcohol and water, (b) the absorption of benzyl alcohol by wool, (c) the effect on the swelling of wool in water of adding benzyl alcohol to the system, and (d) the effect of benzyl alcohol on the absorption from aqueous solutions of a series of neutral-dyeing metal-complex dyes of progressively increasing hydrophobic character.

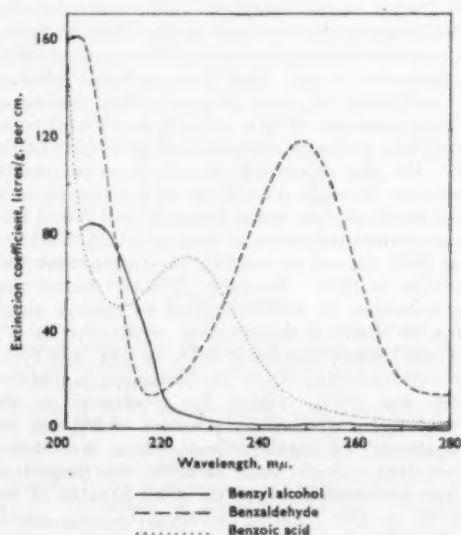


FIG. 1—Absorption Curves of Benzyl Alcohol, Benzaldehyde and Benzoic Acid in Aqueous Solution

SORPTION OF BENZYL ALCOHOL BY WOOL

The sorption of benzyl alcohol by wool was determined by measuring the change in concentration of benzyl alcohol in the external solution. The method employed was spectrophotometric estimation of benzyl alcohol at 209 mμ. At this wavelength errors due to the possible presence of benzaldehyde and benzoic acid were shown to be negligible. The absorption curves of benzyl alcohol, benzaldehyde and benzoic acid, over the range 200–280 mμ., are illustrated in Fig. 1.

In order to determine the time required to reach equilibrium, the experiments were arranged so that the rates of sorption could be measured as follows. A sample of wool (5.50 g.) was weighed accurately and placed in a stainless steel cage so that a cylindrical package (3 in. × 1 in.) was obtained. This was brought to the temperature of subsequent treatment by placing it in a dry tube in a thermostat bath. Benzyl alcohol solution (110 ml.) was then pipetted into a boiling-tube, also immersed in the thermostat bath, and allowed to attain the required temperature. Samples of the solution were then taken to determine the initial concentration of benzyl alcohol. The cage and wool were then placed in the solution and reciprocal agitation applied by a flywheel driven by a geared motor at a constant rate of 30–31 strokes per min. The length of stroke was 1 in., the maximum permissible if the wool was not to emerge above the surface of the liquid.

Samples (1 ml.) of the solution were removed at frequent intervals throughout the experiment and their benzyl alcohol content was determined. The amount of benzyl alcohol sorbed was then calculated by difference and the rate of sorption thus obtained. The experiments were carried out using different initial concentrations of benzyl alcohol and at different temperatures.

Sorption of benzyl alcohol by wool was found to be very rapid, even at 25°C., so that the rate could not be measured accurately with the above arrangement. Equilibrium appeared to be reached in 10 min. at 40°C., and at higher temperatures the rate was even greater. Such high speeds are consistent with the process being one of simple physical absorption.

The equilibrium sorptions were estimated from the final concentrations in the rate experiments, and the results are summarised in Fig. 2 and Table I.

TABLE I
Equilibrium Sorption of Benzyl Alcohol by Wool

Temperature (°C.)	Partition Ratio Alcohol in Wool / Alcohol in Water P	Free Energy of Desorption ΔG° (cal./mole)	Heat of Desorption $\Delta G^\circ + 1.75T$ (cal./mole)
25	2.40	518	1039
40	2.23	498	1045
60	2.00	455	1049
80	1.83	422	1039
100	(1.69)	(396)	
		Mean ΔH° ...	1043

(The values in parentheses were obtained by extrapolation)

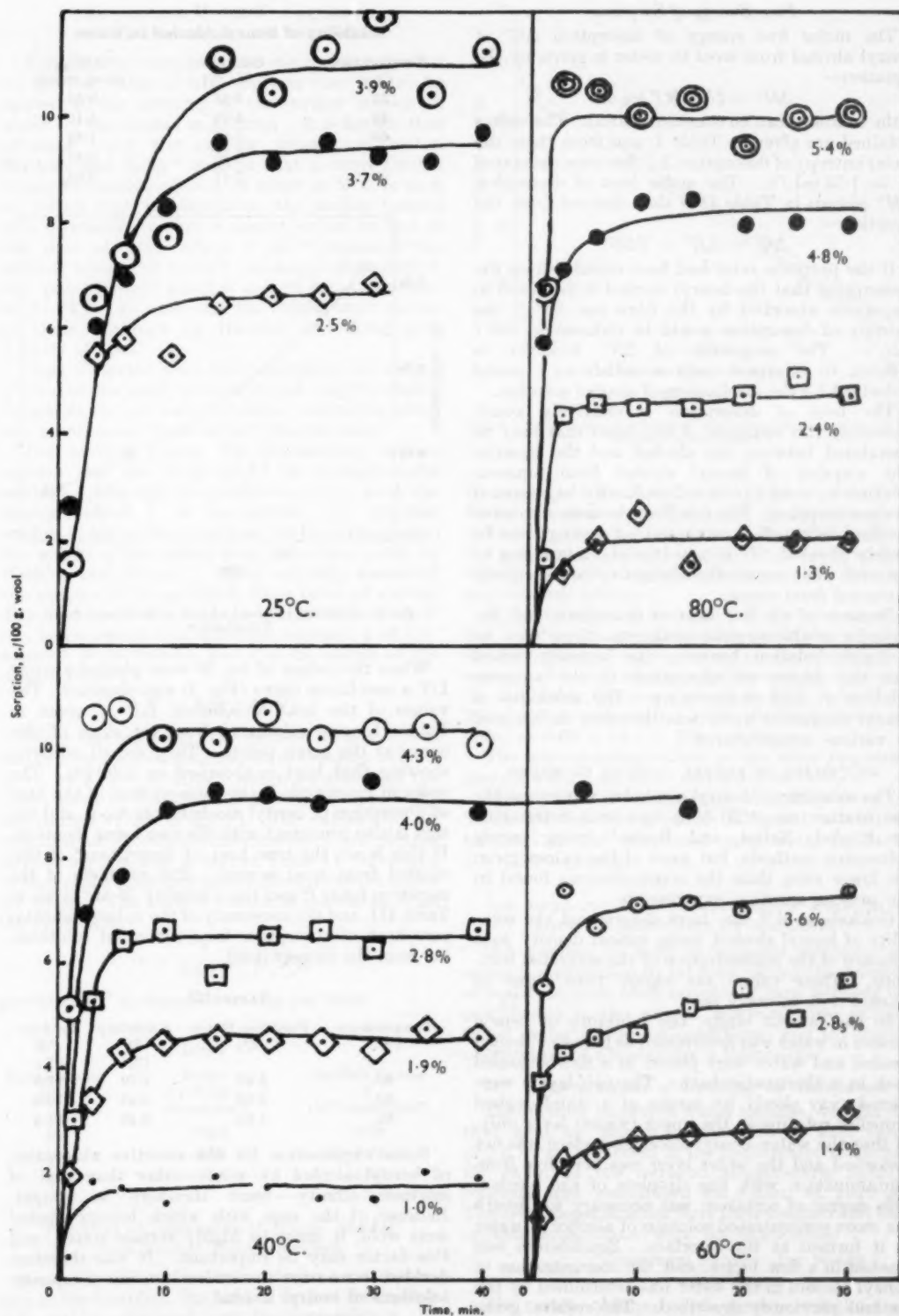


FIG. 2—Rate of Sorption of Benzyl Alcohol by Wool from Solutions of Different Concentration (concentrations shown are estimated final equilibrium values)

Free Energy of Sorption

The molar free energy of desorption ΔG° of benzyl alcohol from wool to water is given by the equation—

$$\Delta G^\circ = 2.303RT \log P$$

if the solutions can be considered ideal. The values obtained are given in Table I, and from them the molar entropy of desorption ΔS° has been estimated to be 1.75 cal./°c. The molar heat of desorption ΔH° (shown in Table I) is then derived from the equation—

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

If the partition ratio had been calculated on the assumption that the benzyl alcohol is dissolved in the water absorbed by the fibre (ca. 30%), the entropy of desorption would be reduced to -0.7 cal./°c. The magnitude of ΔS° , however, is difficult to interpret until a satisfactory model is derived for the mechanism of alcohol sorption.

The heat of desorption is relatively small, indicating the weakness of any bond that may be postulated between the alcohol and the keratin. The sorption of benzyl alcohol from aqueous solution by wool can therefore hardly be regarded as chemisorption. It is not likely to cause excessive swelling, so its effect on the rate of dyeing must be largely physical. It is, nevertheless, interesting to discover what causes the alcohol to be selectively extracted from water.

Because of the low heat of desorption and the linearity of the sorption isotherms, there may be a simple relation between the amount sorbed and the degree of saturation of the aqueous solution at each temperature. The solubility of benzyl alcohol in water was therefore determined at various temperatures.

SOLUBILITY OF BENZYL ALCOHOL IN WATER

The solubility of benzyl alcohol in water over the temperature range 20–55°C. has been determined by Hückel, Neisel, and Buchs¹³ using purely volumetric methods, but some of the values given are lower even than the concentrations found in the present sorption experiments.

Gokhale *et al.*¹⁴ also have determined the solubility of benzyl alcohol, using optical density as a measure of the concentration of the saturated solutions. Their values are higher than those of Hückel *et al.* in every case.

In the present study, the solubility of benzyl alcohol in water was determined as follows. Benzyl alcohol and water were placed in a flat-bottomed flask in a thermostat bath. The two layers were stirred very slowly by means of a stainless-steel propeller rotating in the upper (water) layer only, so that the water-benzyl alcohol interface was not disturbed and the water layer was kept free from contamination with fine droplets of the alcohol. This degree of agitation was necessary to disturb the more concentrated solution of alcohol in water as it formed at the interface. Equilibrium was reached in a few hours, and the concentration of benzyl alcohol in the water was determined by the method previously described. The results, given in Table II, are all higher than those of Hückel *et al.* and of Gokhale *et al.*

TABLE II
Solubility of Benzyl Alcohol in Water

Temperature (°C.)	Solubility <i>M</i> (%)	ΔH°_{sol} (kcal./mole)
25	4.43	0.85
40	4.79	1.10
60	5.47	1.58
80	6.45	2.38
90	7.17	2.95

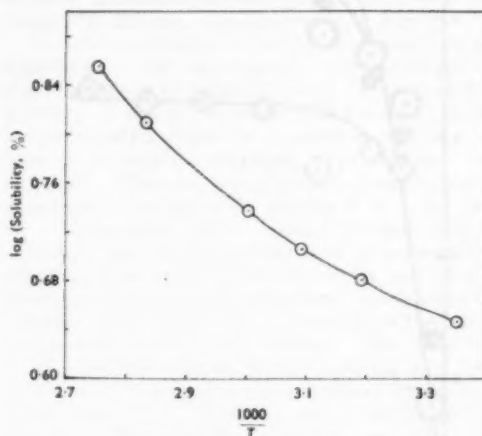


FIG. 3—Solubility of Benzyl Alcohol in Water at Different Temperatures

When the values of $\log M$ were plotted against $1/T$ a non-linear curve (Fig. 3) was obtained. The values of the heat of solution, ΔH°_{sol} , given in Table II, were calculated from the slope of this curve at the given points. They are all positive, showing that heat is absorbed on solution. The order of magnitude is the same as that of the heat of desorption of benzyl alcohol from wool, and the sign is also consistent with the two being identical. If this is so, the true heat of desorption* of this alcohol from wool is zero. The products of the partition ratio P and the solubility M are given in Table III, and the constancy of the values indicates zero heat of absorption from saturated solutions, i.e. from the solvent itself.

TABLE III

Temperature (°C.)	Partition Ratio <i>P</i>	Solubility <i>M</i> (%)	Product <i>PM</i> (%)
40	2.40	4.79	11.5
60	2.00	5.47	10.9
80	1.83	6.46	11.8

Some explanation for the selective absorption of benzyl alcohol by wool—other than that of intrinsic affinity—must therefore be sought. Because of the ease with which benzyl alcohol wets wool, it must be highly surface-active, and this factor may be important. It was therefore decided to measure the surface tension of aqueous solutions of benzyl alcohol.

* The heat to transfer alcohol from wool to alcohol instead of from wool to water.

THE SURFACE TENSION OF AQUEOUS SOLUTIONS OF BENZYL ALCOHOL

The physical nature of the adsorption indicated by the low value of ΔH° suggests that it may be related to the lowering of the surface tension of water by the alcohol in solution. It is known that alcohols lower the surface tension of water. Harkins and King¹⁵ showed that *n*-butyl alcohol lowers the surface tension of water at 25°C. to such an extent that, at saturation, the surface tension of a saturated solution is almost as low as that of the pure alcohol. Clark *et al.*¹⁶ measured the surface tension of benzyl, cinnamyl, phenylethyl, and phenylpropyl alcohols and of benzyl acetate, at 20–24°C. In each case the results were similar to those obtained by Harkins and King with *n*-butyl alcohol.

Thus it seems that the adsorption of benzyl alcohol at the wool–water interface may be similar to that at the air–water interface, values for which can be obtained from surface tension data.

The method chosen for determining surface tension was the drop-weight or stalagmometer method. Although the method is widely used, the theory behind it is incomplete, but accurate studies of the relation between surface tension and the weight of the falling drop have been made by Harkins and Brown¹⁷. They carefully measured the weights of drops falling from tubes of various diameters and found that the weight of the drop W can be expressed as a universal function ψ of r/V , where V is the volume and r is the radius of the drop. Thus—

$$W = 2\pi r \gamma \psi(r/V)$$

Using this equation, the surface tension γ was determined from measurements of the drop volume given by a tube of known radius by means of the table, given by Harkins and Brown, of empirically determined values of $\psi(r/V)$. The values of γ for solutions of different concentration c are plotted against $\log c$ in Fig. 4, and in Table IV the slopes of the graphs for solutions at different temperatures are given. The surface excess is calculated from the expression—

$$\Gamma = -\frac{1}{2.3RT} \partial \gamma / \partial \log c$$

provided RT is expressed in ergs per mole.

TABLE IV

Temperature (°C.)	Slope $\partial \gamma / \partial \log c$ (dynes/cm.)	Surface Excess Γ (10^{10} moles/cm ²)
25	-24.8	4.34
40	-25.4	4.24
60	-25.5	4.00

The Heat of Desorption of Benzyl Alcohol from the Air–Water Interface

Assuming the surface excess to be a concentration in the interface, the heat of surface desorption ΔH_σ can be calculated from the expression—

$$\Delta H_\sigma = 2.3R \partial \log \Gamma / \partial (1/T)$$

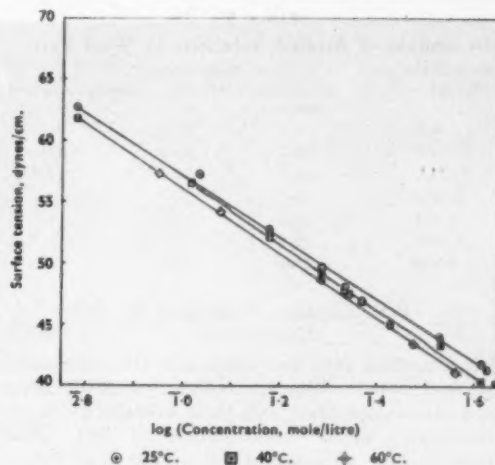


FIG. 4.—Effect of Benzyl Alcohol on the Surface Tension of Water at Different Temperatures

by analogy with that for the heat of solution. From the values in Table IV it appears that ΔH_σ is ca. 500 cal./mole, so it is probable that the sorption of benzyl alcohol by keratin is due mainly to its hydrophobic nature rather than to any intrinsic affinity.

If the interface is assumed¹⁸ to have an area of 2.0×10^6 sq.cm./g. (that which would account for the adsorption of regain water as a monolayer), the amount of benzyl alcohol which would be adsorbed by displacing the water would be $4.34 \times 10^{-10} \times 2.0 \times 10^6 = 8.68 \times 10^{-4}$ moles alcohol/g. wool at 25°C., or $8.68 \times 10^{-4} \times 108 = 9.4\%$.

The corresponding values at the other temperatures are 9.2% at 40°C. and 8.6% at 60°C.

These values are comparable with those given in Table III for the product PM , and would be identical if the interfacial area were, in fact, 2.4×10^6 sq.cm./g.

THE SWELLING CHARACTERISTICS OF WOOL IN AQUEOUS SOLUTIONS OF SOLVENTS

The swelling of wool in aqueous solutions of solvents was studied by (a) determining the amount of liquid retained when samples of yarn, brought to equilibrium in the solvent solution, were centrifuged under controlled conditions, and (b) direct observation of fibres under a microscope.

(a) Determination of Swelling by Imbibition

The method employed was a modified version of that used by Morton¹⁹. Samples of wool yarn (0.5 g.) were immersed in the appropriate solutions for 24 hr. at the required temperature, lightly squeezed and centrifuged for 5 min. at 1000 *g*. The centrifuged samples were then weighed and the imbibition calculated from the relationship —

$$\text{Imbibition} = \frac{\text{Centrifuged Weight} - \text{Dry Weight}}{\text{Dry Weight}}$$

The results obtained with aqueous solutions of *n*-butyl alcohol and benzyl alcohol are given in Table V.

TABLE V

Imbibition of Alcohol Solutions by Wool Yarn

Concn. of Solvent (%, wt./vol.)	Imbibition (%)		
	n-Butyl Alcohol 60°C.	80°C.	Benzyl Alcohol 60°C.
0.0	51.4	51.1	51.4
2.0	50.5	49.4	42.6
4.0	48.5	50.0	48.9
6.5	49.3	—	—
76.4	44.0	—	—
95.0	28.3	—	—
100.0	18.6	20.9	30.3

(b) Determination of Swelling by Direct Measurement

The method used was essentially that of Speakman and Stott²⁰. Lincoln wool fibres were mounted on a microscope slide and their average diameter determined, at a magnification of 300, after immersion in distilled water for 24 hr. and 30 hr., and then again after immersion for 24 hr. and 30 hr. in the appropriate aqueous solvent solution. By using a heated microscope stage it was possible to carry out measurements at 40°C. and 60°C., as well as at room temperature. The results are given in Table VI.

TABLE VI

Diametral Swelling of Wool Fibres

Medium	Swelling* (%)		
	Room Temperature	40°C.	60°C.
Benzyl alcohol, 1% (wt./vol.)	-0.44	—	—
Benzyl alcohol, 2% (wt./vol.)	-1.40	—	—
Benzyl alcohol, 3% (wt./vol.)	-1.67	-0.44	-0.72
n-Butyl alcohol, 4% (wt./vol.)	+0.78	—	—
n-Butyl alcohol, 6% (wt./vol.)	-0.37	-0.07	+0.07
Hydrochloric acid; pH 1	+2.92	—	—

* Swelling is expressed as the increase in average fibre diameter in the aqueous solvent compared with the diameter in distilled water. Average fibre diameters were means of 200 measurements.

Thus, there is no evidence of extra swelling occurring in either aqueous benzyl alcohol or aqueous n-butyl alcohol, compared with water. On the contrary, at higher concentrations of alcohol, where the rate of uptake of dye shows maximum increase, there is slight suppression of swelling.

ABSORPTION OF NEUTRAL-DYEING

METAL-COMPLEX DYES

Neutral-dyeing metal-complex dyes of known structure were chosen and the effect of benzyl alcohol on their rates of dyeing at different temperatures was studied.

Samples of purified wool yarn were dyed in 100-*vol.* baths containing a buffer solution (0.1 *M.* citric acid and 0.2 *M.* disodium hydrogen phosphate) to give pH 5.6, 10 millimoles dye per kg. wool, and 3% (wt./vol.) benzyl alcohol. A Dyeometer (Ganz & Co., Zürich) embodying a Lumetron colorimeter was employed, whereby the exhaustion of the dyebath could be determined at given time intervals from the percentage transmission of the dye solution passing through the colorimeter cell. The dye solution was brought to the required temperature, the wool introduced and dyeing continued with constant agitation of the solution and movement of the yarn. By determining the equilibrium exhaustion, the time of half-dyeing ($t_{1/2}$) could be calculated. The results so obtained are given in Table VII and illustrated by Fig. 5-8.

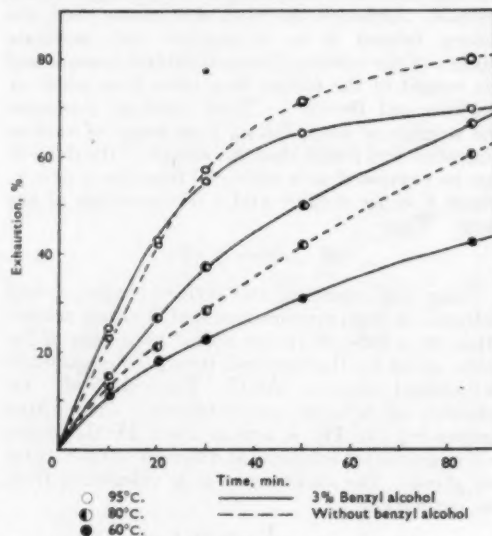


FIG. 5—Effect of Benzyl Alcohol on the Rate of Dyeing of the Sulphonamide Derivative (I)

TABLE VII

Times of Half-dyeing and Equilibrium Exhaustions for 2:1 Dye: Chromium complexes of—

Dye No.	R	Partition Ratio Dye in Benzyl Alcohol Dye in Water	Time of Half-dyeing $t_{1/2}$ (min.)			Equilibrium Exhaustion (%)		
			60°C.	80°C.	95°C.	60°C.	80°C.	95°C.
I	-SO ₂ -NH ₂	55	107 (—)	38 (60)	16 (21)	94.5 (—)	84.5 (95)	74.5 (87)
II	-SO ₂ -CH ₃	332	56 (360)	25 (68)	14 (20)	91.5 (92)	86 (91.5)	77.5 (83)
III	-SO ₂ -C ₂ H ₅	648	28 (420)	20 (52)	12 (18)	94.5 (94)	89 (94)	83 (91.5)
IV	-SO ₂ -C ₃ H ₇	912	8.4 (460)	7.6 (34)	6.8 (12)	97 (97)	94 (97)	88 (94)

The figures in parentheses are values obtained from comparative dyeings in absence of solvent.



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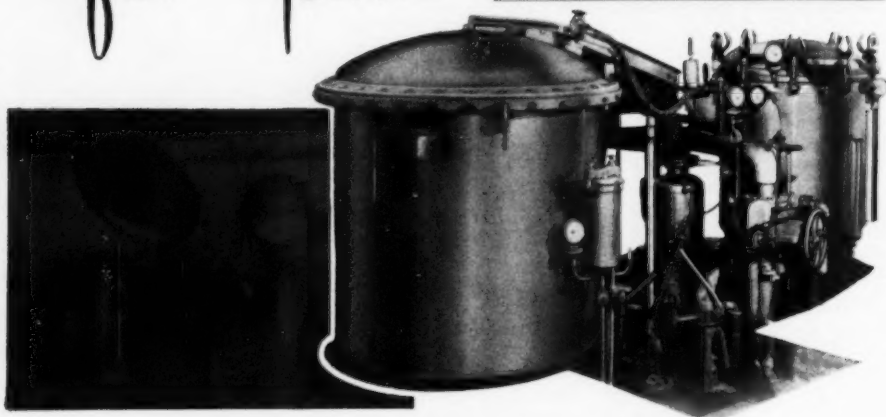


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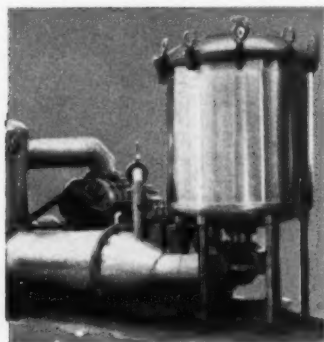


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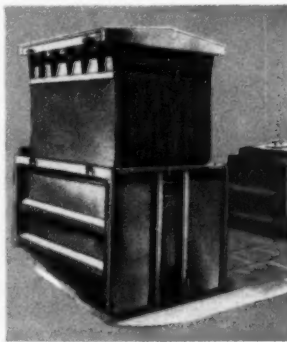


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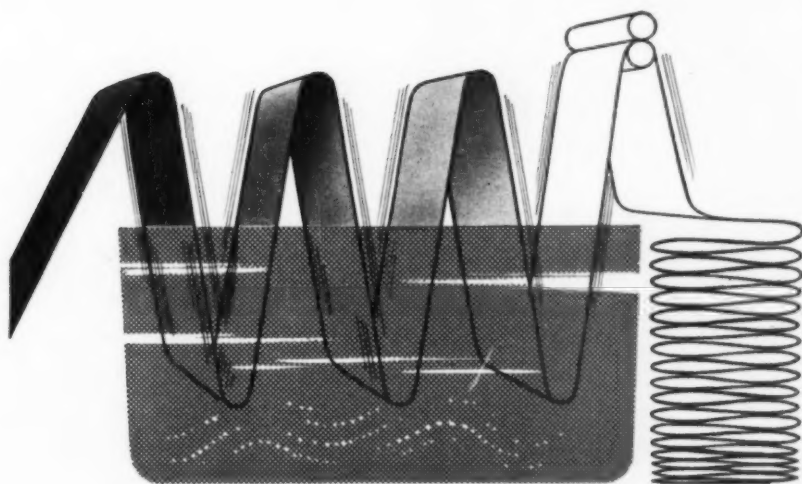
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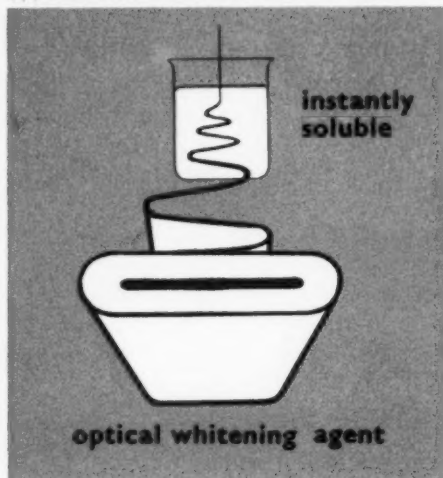
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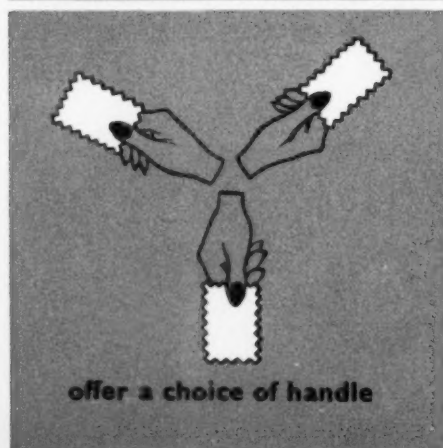
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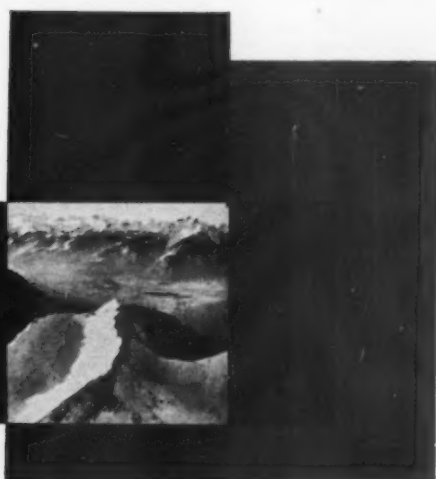
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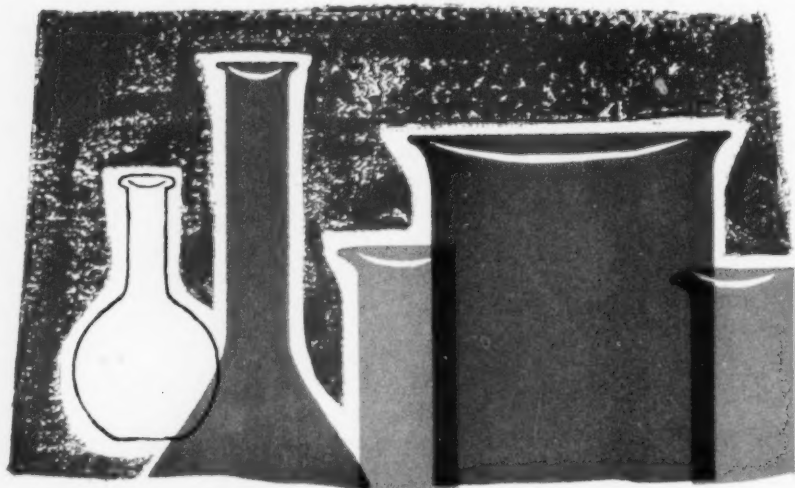


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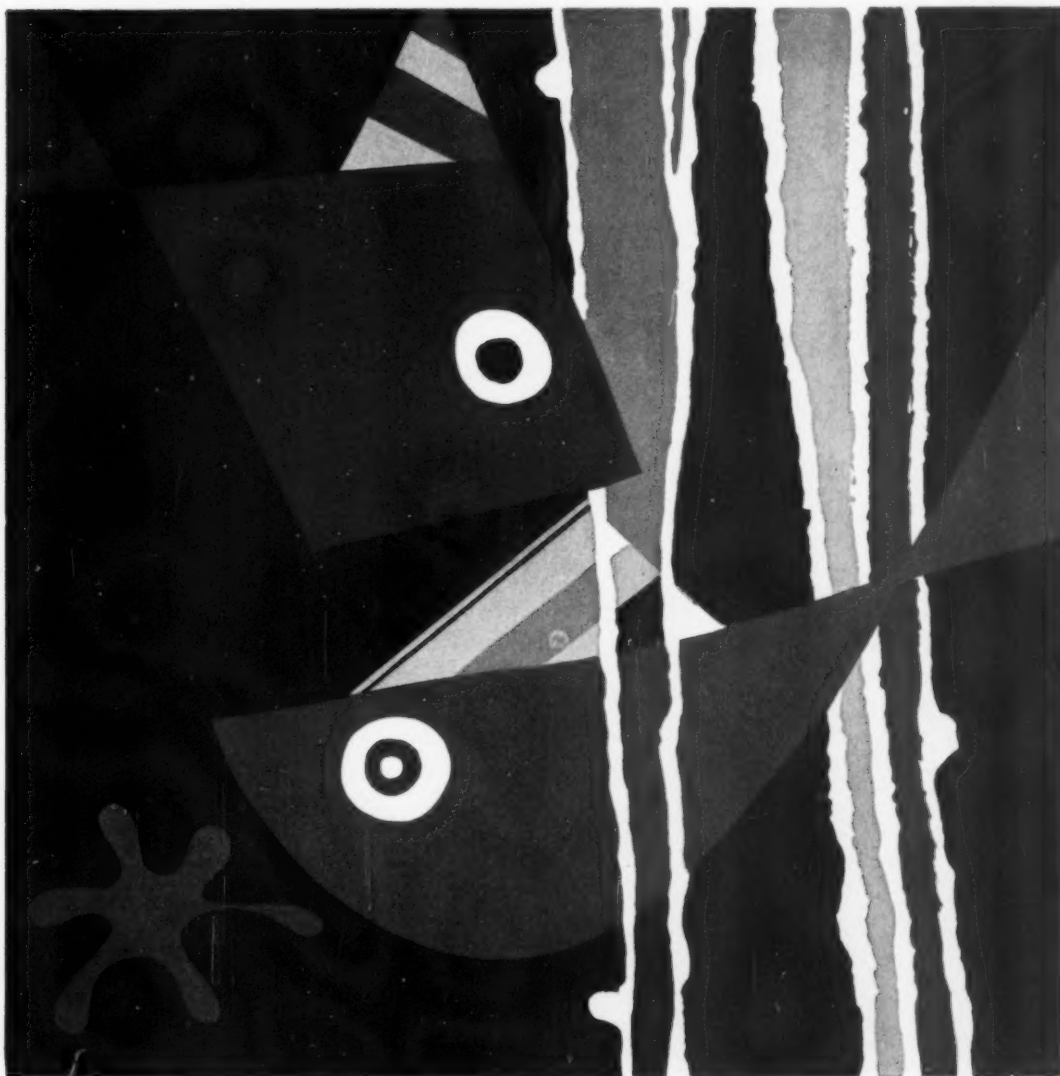
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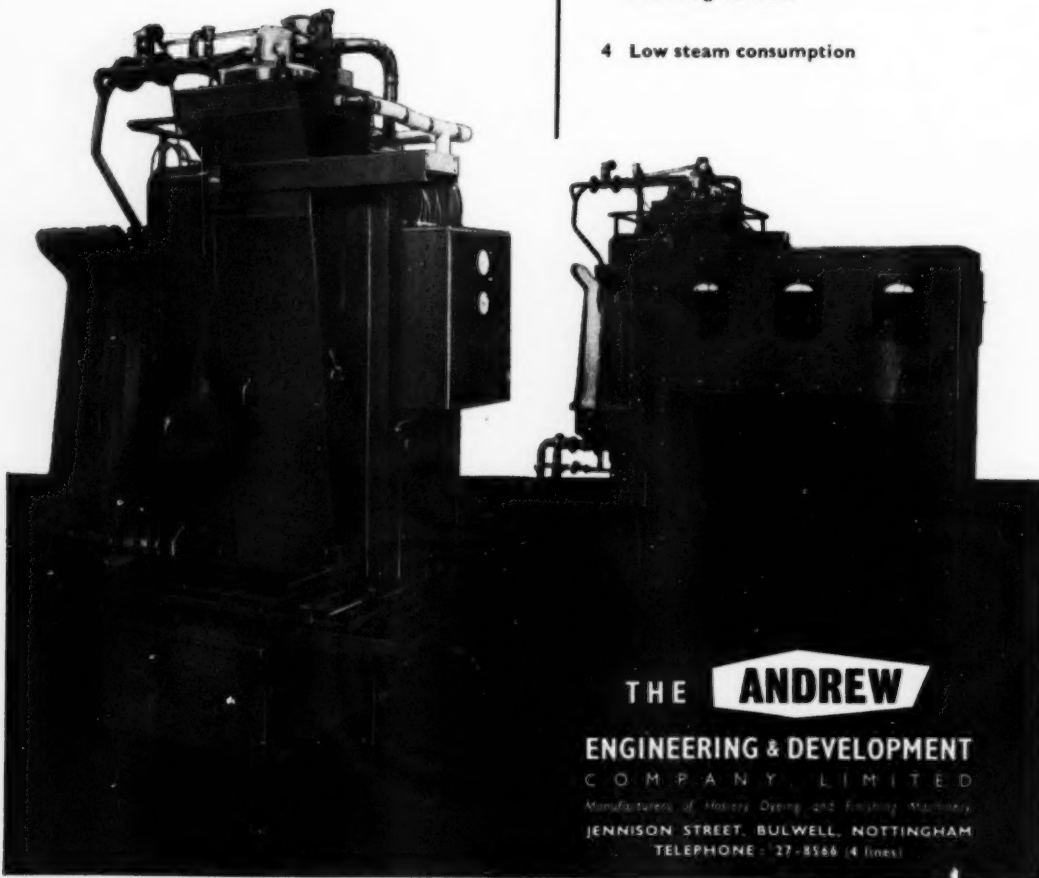
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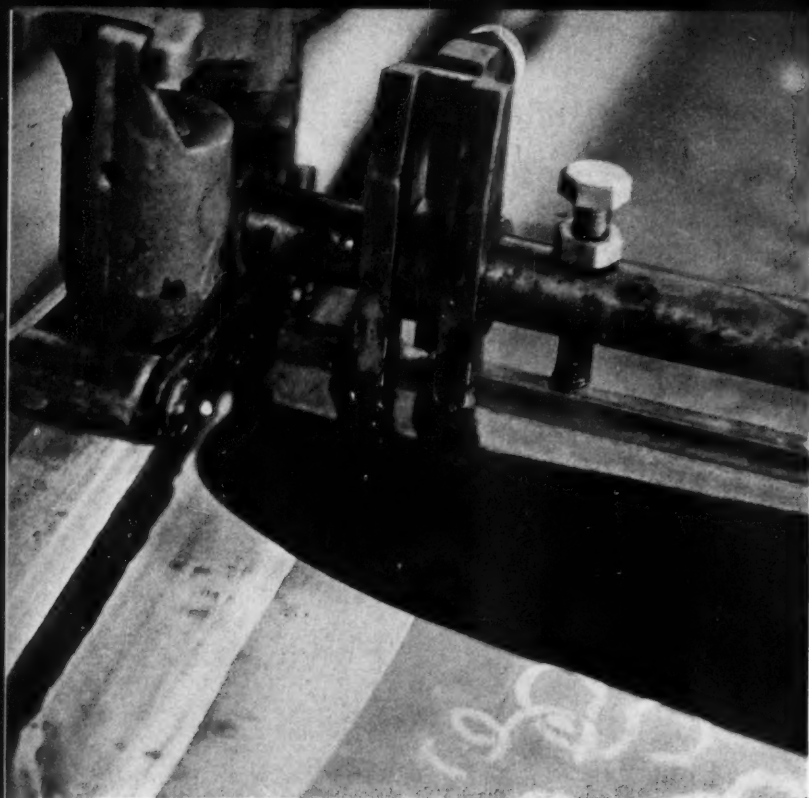


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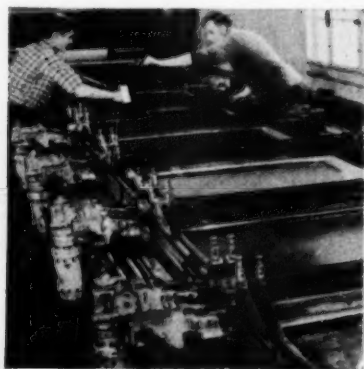
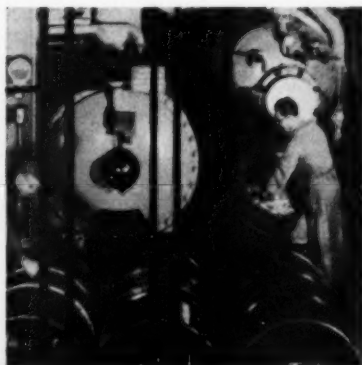
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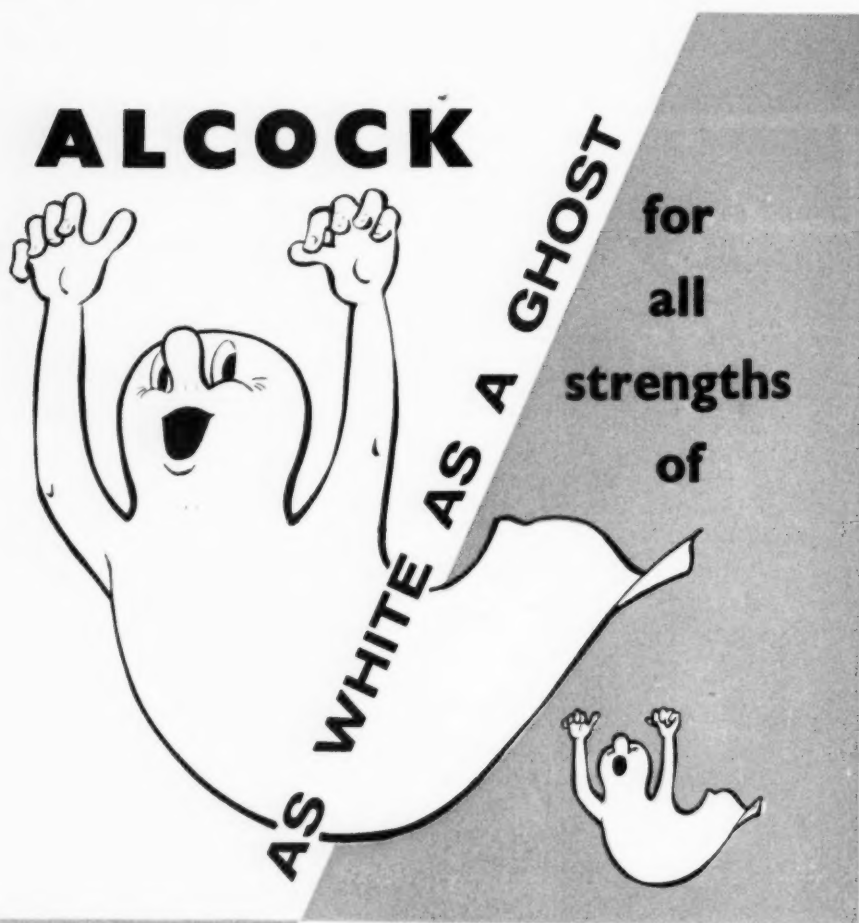
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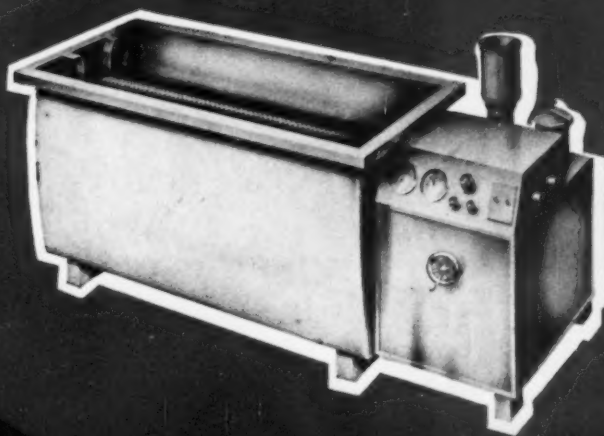
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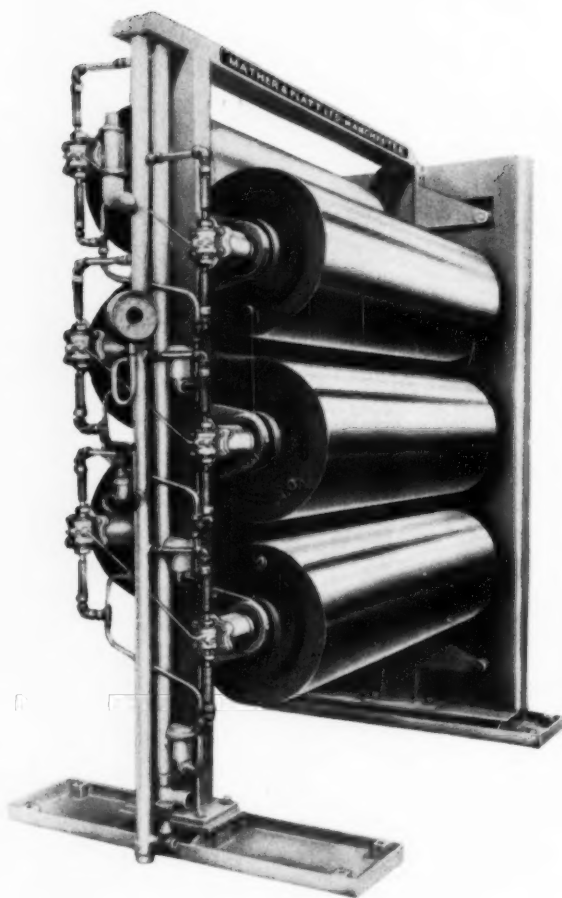


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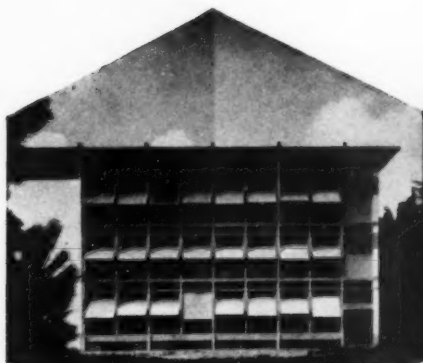
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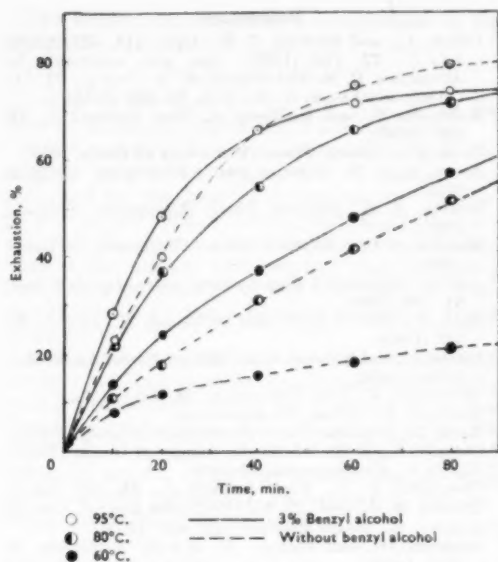


FIG. 6—Effect of Benzyl Alcohol on the Rate of Dyeing of the Methyl Sulphone Derivative (II)

Plots (Fig. 9) of $\log t_{1/2}$ against $1/T$ were not quite linear, but the slopes showed that the heat of activation ΔH^* for dyeing in the absence of benzyl alcohol is ca. 20 kcal./mole for all the dyes—a result which we have found to be fairly general for dyes on wool—indicating that this barrier is most probably caused by the wool-water interface. The reduction in ΔH^* due to the presence of 3% (wt./vol.) benzyl alcohol is shown in Table VIII.

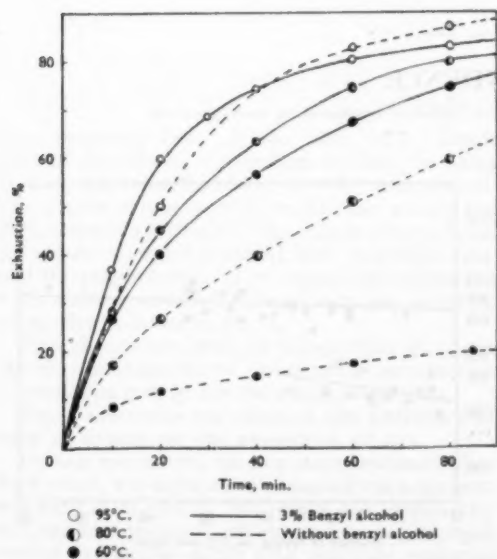


FIG. 7—Effect of Benzyl Alcohol on the Rate of Dyeing of the Ethyl Sulphone Derivative (III)

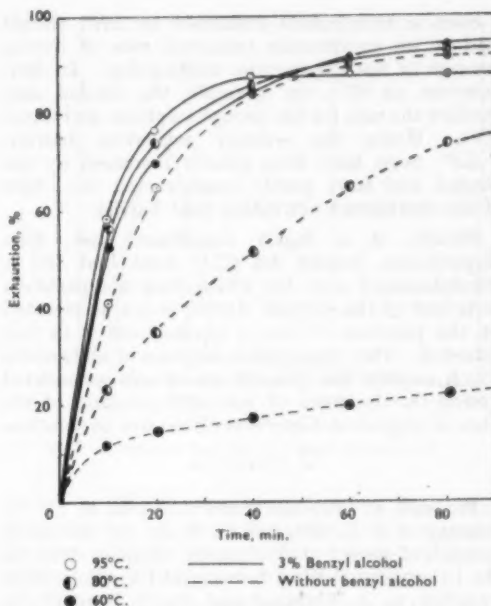


FIG. 8—Effect of Benzyl Alcohol on the Rate of Dyeing of the Propyl Sulphone Derivative (IV)

TABLE VIII
Heat of Activation in Presence of Benzyl Alcohol

Dye No.	ΔH^* (kcal./mole)
I	13.5
II	10
III	4
IV	1.5

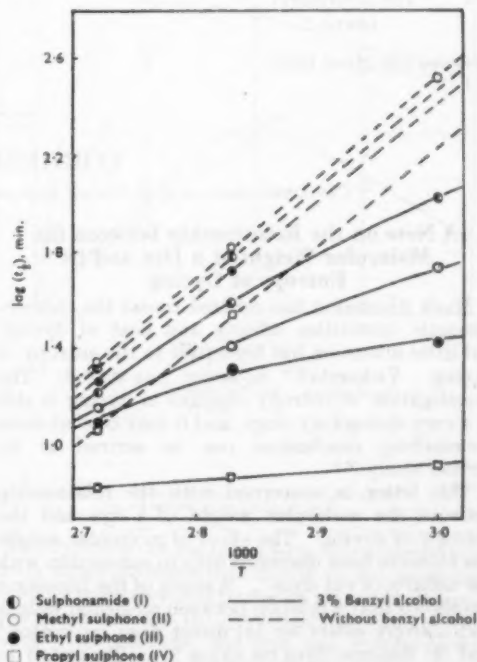


FIG. 9—Effect of Temperature on Time of Half-dyeing

Such a tremendous reduction in ΔH^* should lead to an enormously enhanced rate of dyeing because of the exponential relationship. In fact, however, at 95°C. for example, the alcohol only doubles the rate for the propyl sulphone derivative (IV). Hence the entropy activation barrier, $-\Delta S^*$, must have been greatly increased by the alcohol and have partly counteracted the effect of the diminished activation heat barrier.

Finally, it is highly significant that, with Naphthalene Scarlet 4R (C.I. Acid Red 18), a trisulphonated acid dye which does not partition in favour of the solvent, dyeing is not accelerated by the presence of benzyl alcohol, but is in fact retarded. This observation disposes of all theories which explain the phenomena of solvent-assisted dyeing on the basis of increased swelling of the fibre or improved dispersion of the dye in solution.

* * *

We wish to offer our grateful thanks to Dr. G. Schetty of J. R. Geigy S.A., Basle, for providing samples of pure 2:1 dye:metal complex dyes; to the International Wool Secretariat for scholarships awarded to J. Budding and B. C. Burdett; to Messrs. Strachan & Co. Ltd., Stroud, for a scholarship awarded to J. A. W. Sykes; to the Wool Textile Research Council for grants towards the provision of chemicals and apparatus; and to Messrs. CIBA Clayton Ltd., Manchester, for their gift of the "Dyeometer" to the Department of Colour Chemistry and Dyeing.

DEPARTMENT OF TEXTILE INDUSTRIES AND
OF COLOUR CHEMISTRY AND DYEING
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(Received 12th April 1960)

References

- Peters, L., and Stevens, C. B., *Dyer*, **115**, 327 (1956); *J.S.D.C.*, **72**, 100 (1956). See also comments by Alexander, P. A., and Stacey, K. A., *J.S.D.C.*, **72**, 241 (1956); and Lister, G. H., *ibid.*, **72**, 286 (1956).
- Kärholm, M., and Lindberg, J., *Text. Research J.*, **26**, 528 (1956);
- Bush, H., *Diploma Thesis* (University of Leeds, 1955);
- Ayers, M. E. B., *Diploma Thesis* (University of Leeds, 1956);
- Stotvig, A. B., *Diploma Thesis* (University of Leeds, 1957);
- Metallia, S. Ch., *Diploma Thesis* (University of Leeds, 1957).
- AATCC, Delaware Valley Section, *Amer. Dyestuff Rep.*, **47**, 789 (1958).
- Beal, W., Bellhouse, E., and Dickinson, K., *J.S.D.C.*, **76**, 333 (1960).
- Peters, L., and Stevens, C. B., *British Patent Application* 10244 (1956).
- Delmenico, J., *Text. Research J.*, **28**, 899 (1957).
- Smith, P. J., *Private communication*.
- Roth, R., *Diploma Thesis* (University of Leeds, 1957).
- Oldfield, N., *M.Sc. Thesis* (University of Leeds, 1957).
- Elliott, J., *Private communication*.
- Choquette, P. J., *Text. Research J.*, **24**, 387 (1954);
- Schuler, M. J., *ibid.*, **27**, 352 (1957); See also ref. 1 and 3.
- Kramer, B., *Reyon Zellwolle*, **10**, 862 (1955);
- Zuckrige, H., and Eichler, F., *S.V.F. Fachorgan*, 58 (Feb. 1959);
- Dorset, B. C., *Text. Manuf.*, **80**, 194 (1954).
- Hückel, W., Neisel, M.-Th., and Buchs, L., *Ber.*, **77B**, 334 (1944).
- Gokhale, M. K., Peters, L., and Stevens, C. B., *J.S.D.C.*, **74**, 236 (1958).
- Harkins, W. D., and King, H. H., *Kansas State Agric. Coll. Tech. Bull.*, No. 9.
- Clark, C. R., Degont, J., Denard, L., and Dervichian, D. G., *Surface Chemistry* (London: Butterworth, 1949), p. 173.
- Harkins, W. D., and Brown, F. E., *J. Amer. Chem. Soc.*, **41**, 499 (1919).
- Rowen, J. W., and Blaine, R. L., *Ind. Eng. Chem.*, **39**, 1659 (1947).
- Morton, T. H., *Report No. 3231* (Text. Research Labs., Courtaulds Ltd., Bocking, Essex, Mar., 1948).
- Speakman, J. B., and Stott, E., *Trans. Faraday Soc.*, **30**, 539 (1934).

CORRESPONDENCE

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A Note on the Relationship between the Molecular Weight of a Dye and its Entropy of Dyeing

Much discussion has centred round the thermodynamic quantities affinity and heat of dyeing, but little attention has been paid to the entropy of dyeing. Vickerstaff¹, however, has stated: "The investigation of entropy changes in dyeing is still in a very elementary stage, and it may be that more far-reaching conclusions can be arrived at by further study."

This letter is concerned with the relationship between the molecular weight of a dye and the entropy of dyeing. The effect of molecular weight has hitherto been discussed only in connection with the affinity of vat dyes². A study of the literature has shown that a relation between molecular weight and entropy exists for (a) direct dyes on cotton³ and (b) disperse dyes on nylon⁴, as illustrated in Fig. 1.

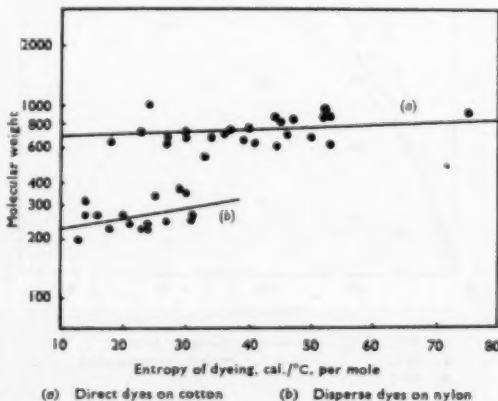


FIG. 1.—Relation between Entropy of Dyeing and Molecular Weight

The linear relation in Fig. 1 is expressed by the equation—

$$\log M = a + b\Delta S$$

where M is the mol. wt. of the dye, ΔS is the entropy of dyeing, and a and b are constants.

Some relation between molecular weight and entropy might be expected. If affinity (as indicated by the heat of dyeing) is due to non-polar van der Waals forces, the larger the dye molecule the greater should be the heat of dyeing. Since it has already been shown⁵ that a relation exists between heat of dyeing and entropy, there should also be a relation between molecular weight and entropy.

It is noteworthy that the gradients of the lines in Fig. 1 are both positive, thus indicating a similar dyeing mechanism. Since the gradient is greater with the disperse dyes, the entropy of dyeing with direct dyes is more sensitive to the effect of molecular weight. This may indicate that disperse dyes are less influenced by non-polar van der Waals forces than are direct dyes.

K. ODAJIMA

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10th June 1960

¹ Vickerstaff, T., *The Physical Chemistry of Dyeing* (London: Oliver & Boyd, 2nd Edition 1954), p. 119.

² Idem, *ibid.*, p. 307.

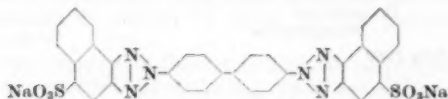
³ Urahata, T., *J. Chem. Soc. Japan, Industr. Chem. Sect.*, **59**, 1171 (1956); **60**, 1468 (1957).

⁴ Nishio, M., Tenth Annual Conference of the Chemical Society of Japan (April 1957).

⁵ Odajima, K., *J. Soc. Textile Cellulose Ind. Japan*, **14**, 981 (1958).

The Dyeing Properties of a Triazole Derivative of Congo Red

The triazole derivative—



was prepared from Congo Red (C.I. Direct Red 28) as follows. Congo Red (0.1 mol.) in water (1 litre) was treated at 95°C. for 1 hr. with crystalline copper sulphate (60 g. in 240 ml. water) and 25% ammonia (120 g.)¹. The copper was removed by means of water acidified with sulphuric acid, and the product purified by repeated precipitation with sodium acetate². The absorption spectrum of the dye is shown in Fig. 1.

The absorption band of Congo Red at about 500 mμ. has disappeared, owing to the introduction of insulating groups into the conjugated chain.

Fig. 2 illustrates the effect of salt addition and time of dyeing on the absorption of dye.

Dyeing was carried out in a stoppered hard-glass flask which was agitated mechanically in a thermostat bath at 90±0.5°C. The cotton was prepared by the standard method³, which consists in prolonged boiling in aqueous alkali with complete exclusion of air, no bleaching treatment being included. A very large liquor:fibre ratio was employed, viz.

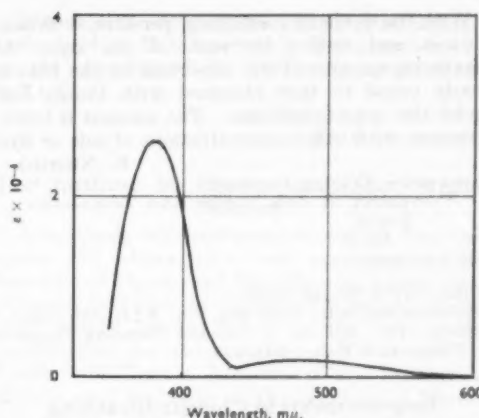


FIG. 1—Absorption Spectrum of Triazole Derivative of Congo Red

10,000:1. The dye was removed from the cotton after dyeing by treatment with 25% aqueous pyridine and the concentration of the resulting solution was determined colorimetrically.

In Fig. 2 it is seen that the amount of dye absorbed by the fibre passes through a maximum and decreases with longer dyeing times. This behaviour suggests that the dye is very sensitive to electrolytes and that the degree of coagulation is dependent on time. The dye decomposed very slightly in the dyebath, but this was insufficient to account for its behaviour.

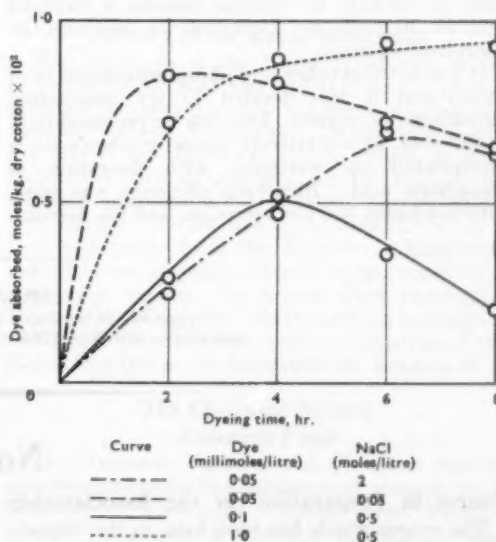


FIG. 2—Effect of Salt and Time of Dyeing on Absorption of Triazole Dye

The dye does not contain a long conjugated chain which would promote coplanarity of the aromatic nuclei by resonance and probably favour hydrogen-bond formation by the groups at the ends of the chain. Nevertheless, the dye has substantivity in a dyebath containing low concentrations of dye and salt.

With the dyebath containing, per litre, 0.05 mol. of salt and 0.05×10^{-3} mol. of the dye, the maximum amount of dye absorbed by the fibre is nearly equal to that obtained with Congo Red under the same conditions. The amount is lower, however, with other concentrations of salt or dye.

K. NISHIDA

FACULTY OF TEXTILE INDUSTRY
UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
TOKYO
JAPAN

29th June 1960

¹ Ciba, USP 2,788,345 (1957).

² Robinson and Mills, *Proc. Roy. Soc.*, A 131, 576 (1931).

³ Dorée, *The Methods of Cellulose Chemistry* (London: Chapman & Hall, 1933), p. 5.

Improvements in Chlorite Bleaching

When using a chlorite bath acidified in the normal manner, e.g. with acetic acid, losses occur owing to the formation of chlorate and escape of chlorine dioxide, together with a little free chlorine, and with some corrosion of metal plant. Under normal conditions the chlorate formed does not bleach.

In the course of investigations in these laboratories, it was found that the losses decreased (roughly exponentially) from almost total decomposition of the chlorite at pH 3.0 to about 7% loss at pH 5.0. Corrosion of 18:8 stainless steel decreased similarly.

If ammonium dihydrogen phosphate is used as a buffer, the total losses occur as before, but the ratio of chlorate to chlorine dioxide is changed from 30:70 to 65:35. Corrosion was less with the phosphate addition.

It was felt that other acid phosphates might be of value, and it was decided to try magnesium dihydrogen phosphate. This can be prepared only in the cold, as a relatively insoluble phosphate is precipitated on warming, with liberation of phosphoric acid. Bleaching efficiency was good, with low losses and low corrosion, and the decrease

in "fuming" was such as to enable bleaching to be carried out in the laboratory in open vessels without the discomfort attending ordinary acid baths, even on increasing the working temperature from 85° to 95°C. It should be noted that the use of phosphoric acid alone for acidifying the bath resulted in almost as much evolution of chlorine dioxide as with acetic acid.

The bath with magnesium dihydrogen phosphate appears to be efficient for cotton, heat-discoloured nylon, etc.

The quantity required is difficult to assess, as the pH of the initial cold bath gives little indication. It will depend upon local conditions in respect of temperature, time available for bleaching, type of bleaching, etc. Further investigations are being undertaken in order to determine the optimum conditions for full economic value.

At present we are using the following quantities—

Sodium chlorite (80%)	0.6 g.
Water	200 ml.
Magnesium dihydrogen phosphate (as pre-prepared solution)	0.44 g.

In practice the following quantities are equivalent, and have been used in successful bulk trials in the factory—

Water	100 gal.
Sodium chlorite (80%)	3 lb.
Phosphoric acid (100%)	2 lb.
Magnesium hydroxide	0.6 lb.

The magnesium dihydrogen phosphate can be prepared immediately before use by stirring the acid and hydroxide with a few gallons of water until dissolved, and adding the remaining water and chlorite. Operation from this point is normal.

R. H. PARKINSON

THE LACE RESEARCH ASSOCIATION
GLAISDALE DRIVE WEST
BILBOROUGH
NOTTINGHAM

8th July 1960

ERRATUM

On page 347 of the June 1960 issue, first column, third paragraph, fifth line, 1764 should read 1746.

Notes

Course in Preparation for the Associateship

The course which has been held in the Department of Textile Chemistry at the College of Science and Technology, Manchester, for some years past, designed to help candidates for the Associateship in certain subjects which are not commonly part of the technological instruction in the district, will continue in the coming session.

This course, which is held on three evenings each week, consists of lectures and laboratory exercises in Colour Physics, lectures in the Chemistry of Colouring Matters and High Polymers,

and lectures on Dyeing Theory. In addition, there is an optional class on Advanced Textile Analysis which is conducted by members of the staff of the Shirley Institute.

This course commences on 3rd October 1960 and registration will normally be on September 26th, 27th and 28th between 6 and 8 p.m.

The fee for the complete course will be £6 10s. 0d. or £5 if the class in Advanced Textile Analysis is not taken.

Further particulars can be obtained from the Registrar of the College.

International Federation of Associations of Textile Chemists and Colourists

A meeting of the Council of Delegates was held in Bâle on 26th February 1960 with the Federation's President, Mr. John Boulton, in the chair. It was attended by 26 delegates representing all the 8 countries in the Federation.

The President paid tribute to the memory of the late Honorary Treasurer, Mr. P. Deck (Mulhouse). Mr. R. Freytag (A.C.I.T., Mulhouse) was unanimously elected Honorary Treasurer, with Mr. A. Wærnagaard (Göteborg) and Dr. Leutenegger (Bâle) Honorary Auditors. The 1959 balance sheet and accounts were approved. The capitation levy for 1960 was increased from 0.50 Sw. Fr. to 1.0 Sw. Fr.

The Vice-president, Dr. H. Ris (Bâle), reported on the work of a committee set up to coordinate the scientific and technical work of the individual associations. Consideration of ways of achieving this has been in progress since 1956. The Council unanimously accepted the following proposals—

- (1) Each association is to nominate a small technical subcommittee of at most 3 members
- (2) These subcommittees will have as their objects—
 - (a) Collection of interesting material, so that papers already published can be revised and then translated into other languages. Search should, however, be made for unpublished material. Publication in technical journals could be arranged by the individual associations.
 - (b) Choice of subjects from research and industrial practice and the obtaining of authoritative authors to deal with them.
 - (c) Holding of technical meetings to which each country should send at most 5 or 6 delegates who should be fully empowered to deal with the matters under discussion. Choice of recorders for these meetings is not to be given to any particular country.
 - (d) Reports of these meetings can be published in the proceedings of the individual associations or of an international congress or in technical journals.

Dr. T. Vickerstaff agreed to see to the carrying out of this programme and the necessary liaison between the different associations.

The President said that the associations of a number of countries were interested in the International Federation, including U.S.A., Canada, Brazil, Hungary, Poland, and Bulgaria. He referred to his remark made at the conclusion of the London Congress that at the next congress there would be an increase in the number of countries represented. The Council agreed to the principle that the Federation's membership should be widened. Applications for membership received from the Polish and Bulgarian Colourists Associations, which the President warmly presented, were referred for examination to see if they comply with the Federation's rules and regulations.

It was agreed to accept the invitation of the Nederlandsche Vereniging voor Textiel-Chemie to hold the next International Congress in Amsterdam on 13th and 14th April 1962.

The next meeting of the Council was arranged to be held in Mulhouse on 22nd September 1960 on the occasion of the Jubilee Congress of the A.C.I.T.

M. PETER
(I.F.A.T.C.C. Secretariat)

The Institute of Physics and The Physical Society

A new body was incorporated on 17th May 1960 under the above title and amalgamates The Institute of Physics and The Physical Society, both of which will shortly be formally wound up and their assets handed over to the body. The qualification for the awards of Fellow of The Institute of Physics, Associate of The Institute of Physics, and Graduate of The Institute of Physics will remain unchanged and members of the new body holding these diplomas will also be Fellows of The Physical Society. Besides the three "Institutes of Physics" grades of membership of the new body there will also be the grade to be known as "Fellow of The Physical Society". All Fellows of the old Society will be automatically transferred to this new grade but new candidates for election to the grade will be required to possess a degree or diploma in physics recognised by the Council, or to satisfy the Council that they have a sufficient knowledge of physics. The registered offices and headquarters of the new body are at 47 Belgrave Square, London, S.W.1, and for the present offices will also be retained at 1 Lowther Gardens, South Kensington, London, S.W.7.

Library of the Royal Institution

The Managers of the Royal Institution desire it to be known that the Institution's Library is open for purposes of study to persons who are not members of the Institution. Admission to the Library is by Reader's Ticket, which is free. Holders of such tickets may use the Library for reference purposes only and cannot borrow books.

A Reader's Ticket has to be applied for on a form obtainable from the Secretary. Applicants must be over 18 years old and be sponsored by a responsible person who knows them personally. Information about the Library and its contents is obtainable from the Secretary or Librarian of the Royal Institution, 21 Albemarle St., London, W.1.

The Chemical Society Research Fund

The Research Fund of the Chemical Society provides grants for the assistance of research in all branches of Chemistry. About seven hundred pounds per annum is available for this purpose. Applications for grants will be considered in November next and should be submitted on the appropriate form not later than Tuesday, 15 November 1960. Applications from Fellows will receive prior consideration.

Forms of application together with the regulations governing the award of grants may be obtained from the General Secretary, The Chemical Society, Burlington House, Piccadilly, London, W.1.

Report on the Work of the Patent Office during 1959

The 77th Annual Report of the Comptroller-General of Patents, Designs and Trade Marks, which has recently been printed, contains as usual a great deal of statistical information, much of which illustrates the increase in the work which is carried out by the Patent Office. The number of patent applications filed continues to increase and during the year under review reached the record figure of 44,495.

The difficulties in recruiting qualified staff have made it impossible to keep pace with the increasing number of complete specifications; those unexamined at the end of 1959 (37,968) slightly exceeded those which were unexamined at the end of 1958 (36,718). Nevertheless, this represented progress, because the increase in the number unexamined was much less than the increase in the number filed (2,775). The Comptroller points out, however, that if the input continues to rise and the staffing difficulty remains, a serious position will arise.

The Report includes a number of items of general information regarding the trend of invention. In the textile field there was marked activity in reactive dyes.

Mention is made of the fact that the widespread public interest in the application for extension of term of the Terylene patent led to requests for admission to the hearing, which the Comptroller had no power to grant, although he did make known the decision to the parties in public. The Rules have since been amended to provide that where there is a hearing of any dispute between two or more parties, the hearing shall be in public unless the Comptroller, after consulting with the parties, otherwise directs.

It is interesting to note that the Patent Office has now installed a Xerographic copying machine—the first in this country apart from that used by the makers—which should speed up the response to orders for copies of documents.

The Report includes short sections dealing with designs and trade marks. There was a reduction in the number of applications for design registration; a fall of 22% in designs to be applied to textile articles accounts for about three-quarters of this drop. As is known, however, the law relating to industrial designs is now under review by a departmental committee appointed by the Board of Trade in May 1959, which is at present receiving papers and hearing evidence.

There has been a steady and continuous increase in the applications for trade marks during the last 10 years and this is thought to arise from the increased advertising of consumer goods and the tendency to seek a trade mark for each new line of goods rather than a trade mark for a whole range of goods.

The Report can be obtained from the Stationery Office, price 1s. 6d. net.

L. E. JONES

Laboratory Course in Dyeing

The stock of the present printing of the book by C. H. Giles is now low and it is intended to have a limited reprint. Reprinted copies will be available shortly.

Textile Institute Warner Memorial Medal

The Textile Institute has awarded the Warner Memorial Medal for 1960 to Professor C. S. Whewell of the University of Leeds. Professor Whewell is a Fellow of the Society and an active member of the West Riding Section. He has lectured frequently to this and other sections of the Society.

London Section Open Technical Evening

A special open Technical Evening will be held in conjunction with The International Rayon and Synthetic Fibres Committee (C.I.R.F.S.), on Wednesday, 19 October 1960, at 6 p.m. at The Royal Society, Burlington House, W.1. John Gwynant Evans, Esq., M.Sc.Tech., Research and Development Director, Bradford Dyers' Association Ltd., will lecture on *Necessity, Invention and Rayon* (an account of some new finishing developments).

The Chair will be taken by the President, F. M. Stevenson, Esq., J.P., M.Sc.

International Congress of the Scientific Film Association

This Congress is being held in Prague on 16-24 September 1960. Further information is available from Scientific Film Association, 3 Belgrave Square, London, S.W.1.

U.S. National Cotton Council Ninth Annual Chemical Finishing Conference

This conference will be held on 27 and 28 September 1960, in the Statler Hotel, Washington, D.C., U.S.A.

AATCC 1960 National Convention

The 1960 National Convention of the American Association of Textile Chemists and Colorists will be held on 6-9 October 1960 in the Sheraton Hotel, Philadelphia, Pa., U.S.A.

Effluent and Water Treatment Exhibition and Convention

The First Effluent and Water Treatment Exhibition is to be held in the Seymour Hall, London, W.1 on 18-21 October 1960. At the same time a Convention will be held with the co-operation of a number of societies and institutions specialising in effluent and water treatment problems. Full particulars of both the exhibition and the convention can be obtained from the Organiser, The First Effluent and Water Treatment Exhibition, Thunderbird Enterprises Ltd., 140 Cromwell Road, London, S.W.7.

Symposium on Adsorption in Industry

A Symposium on *Adsorption in Industry* will be held on 20 and 21 October 1960 by the Institution

of Chemical Engineers, from whom details are available.

Science and Industry: A Blend with the Humanities

Fawley Foundation Lecture, Southampton University

The above lecture is to be delivered by Sir Alexander Fleck, on 10 November 1960.

**The Physical Society
45th Annual Exhibition**

The Physical Society is staging its 45th Annual Exhibition in the Royal Horticultural Society's Hall, Westminster, London, S.W.1, on 16-22 January 1961.

**Oil and Colour Chemists Association
1961 Technical Exhibition**

The Association will hold its Thirteenth Technical Exhibition in the Royal Horticultural Society's Hall, Westminster, London, S.W.1, on 6-9 March 1961.

**International Symposium on
Inorganic Polymers**

A meeting sponsored by The Chemical Society will be held at the University of Nottingham on 18-21 July 1961. A fuller announcement,

indicating the scope of the symposium and giving details of the principal speakers, etc., will be issued in October next. This will be published in *Proceedings of The Chemical Society*, and copies will also be sent to those who apply before 1 October 1960 to the General Secretary, The Chemical Society, Burlington House, London, W.1.

**Conference on Optical Instruments
and Techniques**

A Conference on Optical Instruments and Techniques is being arranged by the British National Committee for Physics, under the auspices of the International Commission for Optics. It will be held in London on 10-14 July 1961. Inquiries should be addressed to Mr. K. J. Habell, National Physical Laboratory, Teddington, Middlesex, England.

Deaths

We regret to report the death of Mr. N. F. B. MacLean and also of Mr. J. R. Blockley, who, in collaboration with Mr. D. H. Tuck, delivered the 1953 Mercer Lecture.

**Meetings of Council and Committees
August**

Council—No meeting

Colour Index Editorial Board—10th

Publications—16th.

New Books and Publications

The Chemistry of Natural Products

Volume IV

The Natural Pigments

By K. W. Bentley. Pp. vii + 306. New York and London: Interscience Publishers. 1960. Price, \$5.00.

The author is also the editor of the series, to which he has previously contributed Vol. I on *The Alkaloids*. (Vols. II and III, by P. de Mayo, deal with the terpenes.) The series adopts some unusual conventions. The text occupies the left-hand page; the right hand is reserved for formulae and reaction schemes. These are handwritten, and it is a quaint conceit of the editor that this adds a "blackboard quality", reproducing "the intimate atmosphere and lucid presentation of the lecture room". The formulae, though neatly and legibly written, are often much too small for comfortable reading, and create an impression of untidiness which is added to by the fact that quantitatively the text and formulae only occasionally agree, and about one-third of the work is blank paper. However, it may be that this way of doing things is cheaper, and accounts for the very reasonable price of the book.

There are twelve chapters, on Flavones and Flavonols, Anthocyanins and Anthocyanidins, Xanthenes, Rottlerin, Brazilin and Haematoxylin,

Porphyrins, Chlorophylls, Bile Pigments, Prodigiosin, Pterin, Quinonoid Pigments, and Polyene Pigments. The field is wide and the author has perforce to be very selective. This selection, and the relative amount of space allotted to the topics covered, is sometimes debatable. It is hard to see why rottlerin should have a chapter of 18 pages to itself. Polyene pigments do well, with 65 pages, but much of this is a monotonous accumulation of syntheses. The large field of quinonoid pigments is given brief treatment; the few examples chosen are hardly representative. The chapters on pyrrole pigments are well written and constitute quite the best section of the book. A sketchy treatment of flavones and anthocyanins is not improved by the frequent omission of the nature and point of attachment of the sugar moieties in the glycosides.

As the reader progresses through the book the impression strengthens that he is reading lecture notes in organic chemistry for the honours school. There is an eclecticism which is fatal to a fair and representative treatment; the emphasis is on the unusual and the complicated; and syntheses are given in all the gory detail required for examination success. As a review of the chemical aspects of natural colouring matters much is lacking. That tinctorial aspects are ignored is to be expected, but why is there not more discussion of light absorption

data, particularly the ultra-violet? Indeed, in some cases the colour of a pigment is not stated. Many important groups of pigments are not mentioned, even in passing, e.g. lichen pigments, melanins. (Perhaps the indigos were excluded on the technical grounds that the colourless precursor is the natural product.) Biogenesis is neglected.

Despite its shortcomings, possibly because of them, this book will undoubtedly appeal to the honours degree student and perhaps to his teacher. The subjects chosen are presented extremely effectively and with formidable scholarship.

There are 435 references. It would have been an advantage if more of these had been to review articles and to topics not selected for detailed treatment.

D. G. LEWIS

Separation and Identification of Food Colours Permitted by the Colouring Matters in Food Regulations 1957

London: The Association of Public Analysts. 1960. Pp. vi + 31 + ii half-tones. Price, 21s. 0d. (postage 9d.).

The promulgation in 1957 of Statutory Instrument No. 1066 laid down the number and type of both synthetic and natural colouring matters which were permitted for use in foodstuffs in the United Kingdom. The Association of Public Analysts, showing an early appreciation of the need for information on this subject, had before this set up a panel to investigate methods for the identification of these colouring matters. The work was organised by a Committee of six, checks being carried out by the individual Public Analyst on the lines of the referee system of the U.S. Association of Official Agricultural Chemists, and the final results were collated and are now published in the above monograph. The booklet covers the 28 water-soluble and the two oil-soluble synthetic coal-tar dyes which are approved, gives recommended methods for the extraction of the dyes from foods and for the identification of the dyes, includes as an appendix spectrophotometric curves of the water-soluble dyes, and contains a suggested method of chemical classification for dyes which would be applicable to the non-permitted dyes.

The most valuable part of the monograph is the section covering the separation of mixtures of the permitted dyes and the identification of the individual dye by paper chromatographic techniques. Information has been published previously in the *J. Assn. Off. Agric. Chem.* and the *Analyst* on this subject but not in the detail and with the wealth of accurate data contained in this small booklet.

Several new solvents are introduced for developing or elution and, with the table of R_f values for all the water-soluble dyes using the six recommended solvents, it is possible to select the correct solvent and obtain an excellent separation of a known mixture and to adjust readily the means of analysing an unknown. The spectrophotometric curves have been examined in 0.1 N-HCl, 0.1 N-NaOH and a solution buffered to neutrality with ammonium acetate. They are well set out and clearly delineated in the appendix.

For those interested in the colouring of food-stuffs, the monograph will be of much value and the information on those dyes also having a textile use may well be of interest to the user in that field. The Association of Public Analysts are to be complimented on the high standard of the monograph and—a small but often overlooked point—on producing a practical hard-cover book with space for notes at the end which facilitates constant reference in the laboratory.

D. F. ANSTEAD

Russian-English-Chinese Glossary of Organic Dyes

Published in Peking, China. 1956. Obtainable from Collet's Scientific Bookshop, 23 Museum Street, London, W.C.1. Pp. ii + 233. Price, 15s. 0d.

This book is written mainly in Chinese characters and gives a list of 470 dyes grouped according to type. Every double page is divided into columns, the first containing the Russian name of each dye; the second two columns give the colour and name of the dye in Chinese characters, while the next column gives its English name. For about 370 dyes, the corresponding structural formula is then given, the rest being described in Chinese. After the structure, Soviet reference numbers are given and then those of Schultz's "Farbstofftabellen". Finally, 1st Edition *Colour Index* numbers are given for about 370 dyes; a random sample taken from those dyes without such numbers shows that all but a few are probably given in the new *Colour Index*. Perhaps dyemakers may care to verify this conclusion more carefully for such dyes as they are mainly concerned with.

At the end of the book, a complete index is given of the names of the dyes in Russian and English with page references.

It is well printed and, in spite of having a paper back, it is very cheap at 15s. 0d. as a list of dyes. Apart from that, it will interest only those who enjoy deciphering hieroglyphs.

L. PETERS

Manufacturers' Publications and Pattern Cards

The Society does not accept any responsibility with regard to the statements in the following notes.
Any publication abstracted may be referred to by members of the Society on application to
Dr. C. B. Stevens, Dyeing Department, Leeds University

Imperial Chemical Industries Ltd.

TECHNICAL INFORMATION LEAFLETS—Dyehouse No. 545. Wool Dyes: An Improved Method of Applying Solochrome Dyes—A modified process (BP 749,631) consists in dyeing from a weakly acid dyebath in presence of sodium dichromate and sodium thiosulphate, each in amount equal to one-fifth of the weight of standard strength dye used. Dyeing is commenced at 40°C., the temperature raised to boiling point during 30 min. and dyeing continued at a vigorous boil for 45 min. Addition of a reducing agent such as thiosulphate speeds up the reduction of the chromate ions and enables fully developed dyeings to be obtained using much smaller quantities of chromate mordant. Thus the amount of chromium fixed upon the fibre is decreased and, consequently, the risk of impairing the spinning properties of the fibre, reducing the light fastness of pale dyeings and dulling the hue is obviated and there is a saving in the cost of the mordant. Sixteen dyes are recommended for application by this process to loose wool, yarn and cloth. A further seven, with one exception yellows, an orange and browns, may also be applied by this method, but the fastness to potting and milling of the resulting dyeings is slightly inferior to that obtained using the normal chromate process.

Dyehouse No. 552. Procion Dyestuffs: Continuous Dyeing of Cellulosic Loose Fibre and Yarns: Supplement No. 2—The information given on the application of cold-dyeing Procions to viscose rayon staple fibre and loose cotton by the pad(bicarbonate)-dry process given in T.I. No. 403 is amplified.

Dyehouse No. 553. Procion Dyestuffs: Application to Gloving Leather and Woolled Sheepskins—Penetration of leathers "mordanted" with cationic materials is often inadequate when using Procion dyes in pale depths. Application, prior to dyeing, of a colourless anionic compound, Lissatan PR, improves dye penetration considerably by competing with the dye for the same dyeing sites in the leather in a manner entirely analogous to that of Lissatan AC with conventional dyes. It is also recommended when dyeing chrome-tanned woolled sheepskins with mixtures of Procion dyes to produce a dyed back/white wool effect.

Dyehouse No. 554. Exposure Studies of Organic Pigments in Paint Systems—Official Digest, 1959, 31 (Part 2), 55-133—This note lists pigments chemically equivalent, or, where these are not available, similar to those referred to by V. C. Vesce in his paper, *Exposure Studies of Organic Pigments in Paint Systems*, now published.

Abstracts from British and Foreign Journals and Patents

The titles of abstracts may be modified. Abbreviations of names of firms are listed in J.S.D.C., 68, 23 (Jan. 1952) and also, together with symbols and the periodicals abstracted, in the annual index

I—PLANT; MACHINERY; BUILDINGS

Machine for Continuous Treatment of Open Width Fabric

W. Bucher *Textil-Rund.*, 15 (April 1960) 207-211
Description, with diagrams, of the Benninger Model LAA machine for continuous wet treatments of fabrics: desizing, scouring, bleaching, soaping, etc. A new feature of the machine is the turbulator. Its rapid oscillation causes the moving fabric to vibrate at high frequency and thus increases the efficiency of the wet treatment.

L.A.T.

The Monforts Reactor—A New Continuous Dyeing Machine

J. C. Roehl *Amer. Dyestuff Rep.*, 49 (16 May 1960) 351-353, 362
A general account of this machine and its possible uses.
C.O.C.

PATENTS

Beam for the Wet Processing of Fabric

Celanese Corp. of America *USP* 2,912,298 (18 Oct 1954)
A beam on which fabric is wound to be wet processed, e.g. beam dyed, has flanges which engage the selvages of the fabric and hold them securely. This holds the fabric firmly in position and prevents it shrinking during processing.
C.O.C.

Blower Nozzles for Cloth Dryers

Vits-Elektro *BP* 835,251 (Germany 14 March 1955)

Carbon Black (C.I. Pigment Black 6 and 7) (IV p. 564)
Fully Automatic Scouring of Wool Fabrics (X p. 571)

III—CHEMICALS; AUXILIARY PRODUCTS; FINISHING MATERIALS

Applications of Dichlorophen in the Textile Industry

R. J. Collins and B. E. Purkiss *Textile Manuf.*, 86 (June 1960) 239-245
Dichlorophen (also known as Panacide in Britain and G.4 in the U.S.A.), 2,2'-dihydroxy-5,5'-dichlorophenylmethane, was first patented as a mothproofing agent but

it is now the most used colourless organic rotproofing agent in the textile industry. An account of its properties is followed by a review of the literature, 46 references.
C.O.C.

Tables of Textile Chemicals

St. Jost *Textil-Rund.*, 16 (May 1960) 248-255
A continuation of previous contributions listing specialities under application headings and giving maker, class, and action.
S.R.C.

PATENTS

Textile Lubricant for Nylon

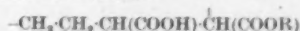
Shell Development Co. *USP* 2,913,407 (29 July 1957)
A lubricant which is readily scoured out and neither stains nor builds up consists of 0.25-3.0% each of (1) an oil-soluble alkali metal sulphonate, (2) a partial ester of a simple alkanepolyol and a fatty acid of > 11 C, (3) a mixture of (a) 60-90% of an ester of a monohydric aliphatic alcohol of 3-8 C and a fatty acid of 1-5 C and (b) 10-30% of a free monohydric aliphatic alcohol, and (4) an oil-soluble alkyl phenol. An example is Na petroleum sulphonate (0.5% by wt.), glycerol mono-oleate (2.25), mixture of isomeric amyl acetates and amyl alcohols (ester content by wt. 85%) (1.5), 2,6-di-4-butyl-4-methyl phenol (0.5), mineral oil (100 SUS at 100°F.) (to bring to 100).
C.O.C.

Sizing Nylon Yarns

Inventa A.G. für Forschung und Patentverwertung *BP* 837,835 (Switzerland 19 July 1957)
A 5-20% aqueous solution of N-polyvinylpyrrolidone or N-polyvinylacetamide is a good size for nylon, cotton and wool yarns.
C.O.C.

Size for Polyester Yarns

Monsanto Chemical Co. *BP* 836,040 (U.S.A. 30 Dec 1955)
Water-soluble ethylene-maleic interpolymers containing recurring units of formula—



(R = H or a group derived from an aliphatic alcohol ROH) and specific viscosity < 0.1 as a 1% solution in dimethyl-formamide at 25°C., are excellent sizes for polyester yarns.

They are readily removed during scouring and require no afterwaxing. C.O.C.

Compositions having both Detergent and Bleaching Properties

Henkel & Cie. BP 836,108 (15 Dec 1955)

A product which has a bleaching action at $< 80^{\circ}\text{C}$. contains an anionic or non-ionic surfactant, a neutral or basic inorganic salt of an alkali metal, a per-compound and as activator a carboxylic anhydride of $< 9^{\circ}\text{C}$ or an organic halogen compound capable of conversion into a carboxylic acid of $< 9^{\circ}\text{C}$, e.g. benzoic anhydride, benzoyl chloride or *p*-chlorobenzoyl chloride. C.O.C.

Fungicide

Dup. USP 2,913,369 (5 July 1955)

Halogenated phenols, halogenated naphthols and halogenated aromatic alcohols when treated with alkoxy polytitanyl acylates or alkoxy polyzircenyl acylates yield fungicides having superior water-repellent properties. C.O.C.

Amino-containing Vinyl Sulphides

Rohm & Haas Co. BP 837,802 (U.S.A. 31 May 1955)

Compounds of formula—

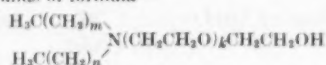


(A = phenylene which may have non-functional ring substituents or an alkylene group having < 2 C atoms between the N and S atoms; R^1 and $\text{R}^2 = \text{H}$ or Alk of 1–5 C or together = a divalent satd. aliphatic chain which with the N atoms forms a heterocyclic group of 5–6 atoms) have bactericidal and fungicidal properties. Some of them are useful for adding to cellulose acetate spinning dopes to yield fibres having high affinity for acid dyes and marked resistance to gas-fume fading. C.O.C.

Polyglycol Ether Derivatives—Dyeing and Stripping Assistants

Ciba BP 835,267 (Switzerland 15 July 1955)

Compounds of formula—



($k = 19-99$; m and $n = 7-17$ and $m + n > 17$) and their acid addition and quaternary ammonium salts are very suitable as agents for shifting the dye equilibrium between an aqueous liquor and nitrogenous fibres, especially wool. Thus the product obtained by condensing a mixture of secondary amines containing unbranched alkyl groups with ethylene oxide (1 mol. amine: < 20 mol. ethylene oxide) is an excellent levelling agent for 1:2 metal-complex dyes and can also be used for stripping some acid and afterchrome dyes. C.O.C.

Bleaching with Hydrogen Peroxide or Per-compounds (VII p. 569)

Treatment of Fabrics with Organic Silicones (X p. 571)

Water-repellent Finish (X p. 572)

Flame-resistant Finish (X p. 572)

IV—RAW MATERIALS; INTERMEDIATES; COLOURING MATTERS

Ionisation Potentials of Organic Dyes and some Aromatic Compounds in the Gaseous Phase

F. I. Vilesov Doklady Akad. Nauk S.S.S.R., 132 (21 May 1960) 632–635

The first "adiabatic" ionisation potentials (IP) of Rhodamine, Indigo Red, Indigo Sky Blue, Merocyanine, Quinoline Blue, Pinaeyanol, and of 14 volatile aromatic cpd. (benzene, naphthalene, anthracene; pyridine, etc.; quinone, etc.; benzaldehyde, etc.) have been determined in the gaseous phase using the method of photo-ionisation (F. I. Vilesov and A. N. Terenin, Doklady Akad. Nauk S.S.S.R., 115 (1957) 744). Within one class of cpd. decrease in IP occurs in proportion to the bathochromic displacement of the first absorption bands, except for acetophenone where IP is slightly higher than that of benzaldehyde. Corresponding IP values calculated by Scheibe's formula (G. Scheibe et al., Chem. Ber., No. 9-10 (1952) 867) are considerably lower. Data for the first 3 absorption bands in the ultraviolet are tabulated. Heating of substances to 250°C . during irradiation has been possible. Neutral hydrocarbons have been used as solvents. G.J.K.

Kinetics of Reduction of Nitrobenzenes by Sodium Disulphide

M. Hojo, Y. Takagi and Y. Ogata

J. Amer. Chem. Soc., 82 (20 May 1960) 2459–2464

Rate of reaction of sodium disulphide and nitrobenzene in 40% (vol.) aqueous methanol studied over temperature range $30-60^{\circ}\text{C}$. by absorption spectrophotometry. Rate was found to be $\propto [\text{ArNO}_2]$ and $[\text{Na}_2\text{S}_2]$, the rate constant increasing linearly with the concn. of NaOH added. Activation energy of the reduction = 16.35 kcal. mole $^{-1}$ and frequency factor = 4.57×10^5 l 2 mole $^{-2}$ sec $^{-1}$. Substituted nitrobenzenes (*p*-OCH $_3$, *p*-CH $_3$ and *m*-COCH $_3$) fitted the Hammett equation. Reaction mechanism involved an attack of S_2^{2-} ion on positive nitrogen of nitrobenzenes in conjunction with hydrolytic equilibrium of the disulphide ion. F.J.

Graphic Representation of the Composition and Adjustment of Sodium Acetate/Acetic Acid Buffer Mixtures in the Preparation of Azoic Dyes

J. L. Weissink and B. R. H. Wormgoor

Tex. 19 (June 1960) 341–347

A method is described whereby it is possible to select a buffer of the prescribed pH and the desired buffering power for that pH. The chemical equivalent amounts of sodium acetate and acetic acid are plotted at equal intervals in opposite directions on two arbitrary vertical axes. The line connecting the two zero points will, therefore, run at an arbitrary slant. All lines joining two points of chemical equivalent amounts ($C_{\text{salt}} = C_{\text{acid}}$) on the vertical axes for salt and acid will cut the zero line exactly in the middle. This point corresponds to pH 4.75 according to Henderson's formula—

$$\text{pH} = \text{pK} + \log \frac{C_{\text{salt}}}{C_{\text{acid}}}$$

Similarly all lines joining other points with the same salt/acid ratio have a common intersection point with the zero line. The pH can be calculated for any of the ratios from Henderson's formula. Also, any line passing through a known pH will cut the acetate and acid axes so that the relationship $C_{\text{salt}} = C_{\text{acid}}$ always is the same and these points give the amount of salt and acid required to give the pH at that point of the zero line, the pH-axis. R.A.

Quenching of Triplet States of Anthracene and Porphyrins by Heavy Metal Ions

H. Linschitz and L. Pekkarinen

J. Amer. Chem. Soc., 82 (20 May 1960) 2411–2416

Decay kinetics have been observed on triplet states of anthracene and some porphyrins in tetrahydrofuran and pyridine containing various metal ions, including Ni^{2+} , Co^{2+} , Cu^{2+} , Cr^{3+} , Mn^{2+} , Gd^{3+} and Sm^{3+} . Quenching rate constants were found, addition of water causing a sharp drop correlated with changes in solvation, indicated by absorption spectra. A charge-transfer mechanism is proposed. F.J.

Studies on Metastable States of Porphyrins. II—Spectra and Decay Kinetics

L. Pekkarinen and H. Linschitz

J. Amer. Chem. Soc., 82 (20 May 1960) 2407–2411

Flash technique, described in J. Amer. Chem. Soc., 82 4826 (1958) has been applied to tetraphenylporphine (I) zinc tetraphenylporphine (II) and bacteriochlorophyll (III) in toluene and pyridine soln. Absorption spectra of metastable states all show a main band below the Soret peak. Near-infrared spectra of triplet states of *a*- and *b*-chlorophyll (C.I. 75810) are also given. Rates of decay obey the equation—

$$-dC^*/dt = k_1 C^* + k_2 (C^*)^2 + k_3 (C^*)(C_g)$$

where C^* , C_g = concn. of metastable and ground state respectively. Rate constants k_1 and k_2 are similar for (I) (II) and chlorophyll-*a* and *-b*, k_3 's being indistinguishable. (III) gives a much faster first-order decay. Complexes of Cu^{2+} , Co^{2+} and Ni^{2+} with (I) showed little or no evidence of triplet states. F.J.

Esterophile Dyes for Dyeing and Printing Polyester Fibres

D. Marian

Amer. Dyestuff Rep., 49 (30 May 1960) 399–402

A new range of dyes for polyester fibres are the Esterophile dyes. They are dispersed polyester-soluble pigments and have outstanding brightness, fastness to light and

sublimation. Four members of the range are now available as powders, suitable for stock dyeing, dyeing of hank and piece goods, padding, and direct and Vigoreux printing. These are Light Yellow 2RL extra, Light Yellow 3RL extra and Light Red RBL extra, which are azoic dyes without ionic character, and Light Blue BJ2R, a homogeneous anthraquinone dye. Theoretical considerations leading to the development of the dyes are discussed and examples given of industrial application in dyeing and printing, together with information on their use in combination with other dyes on union materials, e.g. wool-polyester and cotton-polyester. The four dyes so far available can be used in coordination since they have exhaustion curves of similar character, and since exhaustion is only completed at high temperature, dyeing is preferably controlled (when dyeing Terylene alone) by raising very slowly from 110–130°C. Dyeing with carriers at boiling-point, as is required in wool-polyester unions, may be carried out with adequate results. A.T.P.

Influence of Structure on the Photodichroism of Dyes

V. Kaikaris and J. Dolmatovs

Vilnius Univ. Mokslo Darbai, Chemija

28 (1959) 59–65

Chem. Abs., 54 (10 June 1960) 10459

Collodion and gelatin films were prepared containing various amounts of acridine (I), Acridine Orange (C.I. 46065), Benzo Flavine (C.I. 46065) (II), Phosphine (C.I. 46045), Rhodamine B (C.I. 45170) (III), Rivanol (IV), Safranin T (C.I. 50240) (V) and Trypaflavine (VI). At constant film thickness, optimum dye concentration and illumination time to give maximum photodichroism were determined. I and IV exhibited no photodichroism even after illumination with white polarised light for 30 min. whereas I min. was sufficient for the other dyes. Dyes with the same symmetrically situated auxochromic groups (II, V, VI) had similar photodichroic curves. All the dyes, except III and V, were more sensitive in collodion than in gelatin. The photodichroic curves were similar in both media, except the maximum in gelatin was shifted several mμ (20 mμ. for V) towards longer wavelength. Photodichroic effects with V were greater in collodion when shorter, and in gelatin when longer, illumination times were used. Optimum illumination times for V were 1 min. in collodion and 60 min. in gelatin. This is attributed to the different nature of dye adsorption. C.O.C.

Colour of Inorganic Compounds

S. C. Nyburg

Trans. Brit. Ceram. Soc., 58 (1959) 565–572

Chem. Abs., 54 (10 June 1960) 10617

A brief account of the way current ligand field theory can explain semiquantitatively the colours which the ions of transition elements impart both to pure compounds and to glasses. C.O.C.

PATENTS

Stabilised s-Triazinylamino Compounds

ICI

BP 838,337 (20 April 1956)

The rate of decomposition, during manufacture and on storage, of compounds (I) containing s-triazinyl-2-ylamino groups subst. by ≤ 1 , especially 2, halogen atoms, is reduced by addition of 1–25% (espec. 10%) by wt. of a buffer maintaining pH 6–8. The stabilisation of many types of (I) is described, and a buffer may be added to the reaction mixture during the preparation of I at any stage. When the primary and secondary amines used are colourless alkyl- or aryl-amines the products are intermediates but when they contain a chromophore the products are dyes or pigments. Coloured aminoanthraquinone compounds may also be used. Thus, to a suspension of cyanuric chloride (II) from II (18.5) in acetone (100) added to water (300) and ice (300), is added over 30 min. a neutral soln. of m-aminobenzene sodium sulphonate (19.5) in water (300) at 0–5°C. After stirring for 10 min., the mixture is made slightly alkaline with Na_2CO_3 and the product precipitated by NaCl and filtered. The cake is washed with 10% aq. NaCl and mixed with anhyd. Na_2HPO_4 (7) and anhyd. KH_2PO_4 (12.5) before drying. After keeping the dried product in a glass-stoppered bottle for 6 months, only 1.7% of the reactive Cl on the triazine nucleus had been removed. Similar

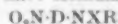
cake dried without the buffer showed 64% Cl removed by hydrolysis. A.T.P.

Nitro Dyes containing a Triazine Nucleus

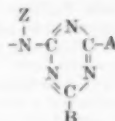
ICI

BP 838,338 (15 June 1956)

Yellow, orange and red-brown dyes of excellent light and washing fastness have formula—



(D = subst. or unsubst. benzene or naphthalene, N is ortho to $-\text{NO}_2$, X = H or subst. or unsubst. hydrocarbon, R = organic radical linked to N through a C atom, or to X when X = hydrocarbon, or to D, ortho to N, in a heterocyclic ring which contains ≤ 1 one



group (A = Hal, B = Ar, Alk, Hal, alkoxy, aryloxy, alkylthio, arylthio, OH, SH, subst. or unsubst. NH_2 , Z = H or subst. or unsubst. hydrocarbon). The dyes are for cellulosic fibres or for wool, silk or synthetic fibres depending on their solubility (SO_3H groups) and are applied by the usual methods for reactive dyes. Thus, to a soln. of 2-nitro-4'-methylaminodiphenylamine-3',4'-disulphonic acid (10) in water (400) and 2 s- Na_2CO_3 (I) (25) and ice to $< 5^\circ\text{C}$, is added cyanuric chloride (II) (4.6) in acetone (25), maintaining pH 7 by addition of I. When a clear solution is obtained, KH_2PO_4 (12) and Na_2HPO_4 (6) are added, followed by KCl (100) and NaCl (50). The mass is stirred and filtered and the dry product, containing 28.8% inorganic matter and 7.9% organically combined Cl, dyes wool and cotton yellow of excellent light and washing fastness. Similarly, a yellow-orange dye for nylon is prepared from II and 2,4-dinitro-3'-aminodiphenylamine. A.T.P.

Black Metal(Chromium)-complex Monoazo Dyes for Wool, etc.

FBY

BP 839,931 (Germany 10 April 1957)

Chromium complexes containing 1 atom of Cr combined with 1 mol. of each of 2 different monoazo compounds—



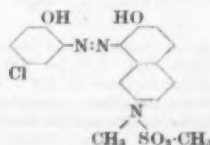
(R^1 = acyl; R^2 = sulphonyl or alkylsulphonyl) dye wool, nylon, etc. black from neutral or weakly acid baths. Thus the monoazo compound 2-amino-4-nitrophenol \rightarrow 1-methanesulphonylamino-7-naphthol is converted into its 1:1 Cr-complex by heating at 120–130°C. in ethylene glycol with CrCl_3 . Heating at 70°C. with the monoazo compound 2-aminophenol-4-sulphonamide \rightarrow β -naphthol in presence of aq. NaOH then gives the required mixed Cr-complex. E.S.

Metal(Chromium and Cobalt)-complex Monoazo Dyes for Wool, etc.

Gy

BP 838,791 (Switzerland 15 July 1955)

The 1:2 Cr- and Co-complexes of monoazo dyes, free of SO_3H and non-complexing COOH groups, are rendered sufficiently water-soluble by the presence of an acylated secondary amino group, the amino N atom being directly attached to the dye molecule. N-Acetyl- and N-methanesulphonyl-N-methylamino groups are particularly effective. Thus 2-naphthol-7-sulphonic acid is converted by the Bucherer reaction into N-methyl-2-naphthylamine-7-sulphonic acid, which is alkali-fused to give N-methyl-2-amino-7-naphthol, which is then N-acetylated with methanesulphonyl chloride. The product is alkali-coupled with diazotised 2-amino-4-chlorophenol giving



The Co-complex, obtained by heating with aq. cobalt acetate in presence of tartaric acid, dyes wool red from a neutral or weakly acid bath. Examples of 34 dyes are given, as well as an outline of the preparation of several of the intermediates. E.S.

Metal(Chromium and Cobalt)-complex Monoazo Pyrazolone Dyes for Wool and for Colouring Lacquers, etc.

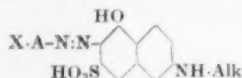
Ciba BP 838,657 (Switzerland 16 Feb 1956)

Chloro- and nitro-derivatives of *o*-aminophenol are diazotised and coupled with esters or amides of 5-pyrazolone-3-carboxylic acid, and the monoazo compounds so formed are converted into 1:2 complexes with Co or Cr to give mainly reds which may be applied to wool, etc., but being highly soluble in esters and alcohols are specially suitable for colouring lacquers, etc. Thus the monoazo compound 2-amino-4-methyl-6-nitrophenol-5-pyrazolone-3-carboxylic acid *n*-butylamide is refluxed with aq. sodium chromosalicylate to give a claret for nitrocellulose lacquer. E.S.

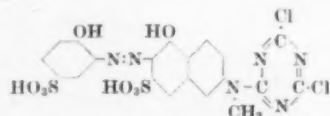
Copper-complex Monoazo Reactive Dyes for Cellulose

ICI BP 837,985 (5 July 1957)

The Cu-complexes derived from monoazo compounds—

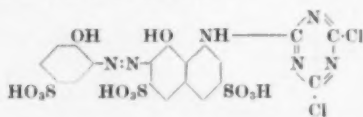


(A = Aryl containing at least 1 SO₃H group; X = *ortho*-substituent capable of metal-complex formation) are condensed with 1 mol. of a cyanuric halide to give the title dyes. Thus the monoazo compound 2-aminophenol-4-sulphonic acid-*N*-methyl-J acid is boiled with aq. CuSO₄, and the complex so formed is condensed at 0-5°C. with cyanuric chloride giving the reddish violet Cu-complex of—



ICI BP 838,311 (5 July 1957)

The Cu-complexes of monoazo compounds X-A-N=N-B-NHR (A = Aryl residue; X = *ortho*-substituent capable of metal-complex formation; B = naphthalene residue containing at least 2 SO₃H groups; R = H or Alk; NHR may be attached to B through an acylamino group) are condensed with 1 mol. of a cyanuric halide to give similar dyes. Thus the alkali-coupled monoazo compound 2-aminophenol-4-sulphonic acid-*H* acid is boiled with aq. CuSO₄, and the Cu-complex so formed condensed with 1 mol. of cyanuric chloride giving the reddish violet Cu-complex of—

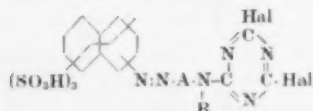


E.S.

Yellow and Orange Monoazo Reactive Dyes for Cellulose

ICI BP 838,307 (5 June 1957)

The title dyes of formula—



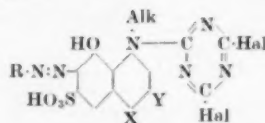
(A = 1,4-phenylene or naphthylene which may have substituents other than OH, NH₂ or NHAlk; R = H, CH₃ or C₂H₅) are similar to those of BP 774,925 (J.S.D.C., 73 (1957) 433) in which the diazo components are mono- and di-sulphonic acids of 5-naphthylamine instead of naphthylaminetrisulphonic acids. Thus the monoazo

compound 2-naphthylamine-3,6,8-trisulphonic acid-*m*-toluidine is condensed with 1 mol. of cyanuric chloride to give a reddish yellow dye. E.S.

Orange and Red Monoazo Reactive Dyes for Cellulose

ICI BP 838,341 (25 Jan 1957)

Reactive dyes—

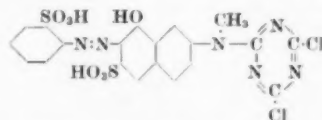


(R = Ar free from OH, NH₂, and NHAlk groups; X and Y = H, or one of them SO₃H) have improved fastness to alkali, and do not suffer undue loss in light fastness upon application of a crease-resist resin finish, if the aryl radical R contains *ortho* to the azo link an electronegative group, e.g. SO₃H, COOH, CN, SO₂NH₂, CF₃, etc. Thus *N*-ethyl-H acid is condensed with 1 mol. of cyanuric chloride, and the product is coupled with diazotised 4-aminoanisole-3-sulphonic acid. E.S.

Orange and Red Monoazo Reactive Dyes for Cellulose

ICI BP 838,340 (14 Sept 1956)

Monoazo compounds obtained by coupling diazotised orthonilic acid and its derivatives with γ acid or its *N*-alkyl (especially methyl) derivatives under alkaline conditions are condensed with 1 mol. of cyanuric chloride to give the title dyes. An example is the bright reddish orange—

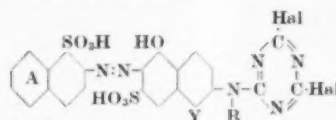


E.S.

Orange and Red Monoazo Reactive Dyes for Cellulose, of Good Fastness to Hypochlorites

ICI BP 837,990 (30 Oct 1957)

The title dyes are of formula—

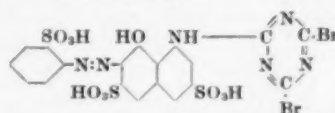


(naphthalene nucleus A may contain 1 or more additional SO₃H groups; Y = H, Cl or SO₃H; R = H or Alk of 1-4 C; Hal = Cl or Br) and are faster to bleaching with aq. hypochlorites than the similar dyes of BP 785,120 (J.S.D.C., 74 (1958) 58) in which the diazo component is orthonilic acid instead of 2-naphthylamine-1-sulphonic acid and its derivatives. Thus the monoazo compound 2-naphthylamine-1,5-disulphonic acid-*J* acid is condensed cold with 1 mol. of cyanuric chloride, to give a reddish orange dye. E.S.

Monoazo Reactive Dyes for Cellulose Derived from Cyanuric Bromide

ICI BP 838,342-5 (13 March 1957)

Reactive dyes similar to those described in BP 785,120, BP 785,222 (J.S.D.C., 74 (1958) 58), BP 774,925 (J.S.D.C., 73 (1957), 433), and BP 826,405 (J.S.D.C., 76 (1960) 195) but containing a 4,6-dibromo-*s*-triazinyl residue instead of a 4,6-dichloro-*s*-triazinyl residue have similar properties. Thus the compound—

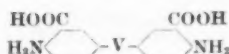


gives reds of high wash fastness on cotton when applied in conjunction with an alkaline treatment. E.S.

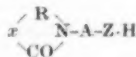
Yellow and Brown Metallisable Disazo Direct Dyes

S BP 839,673 (Switzerland 17 April 1957)

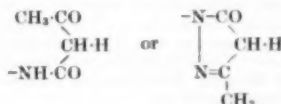
Diamines—



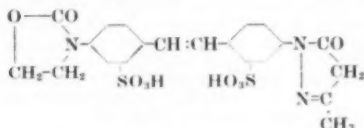
(V = direct link, or a residue of urea, or of an ethylene (or butadiene-1,4- or benzene-1,4) dicarboxylic amide) are tetrazotised and coupled with 2 mol. of a coupling component—



($x = \text{O}$ or a direct link; $R =$ hydrocarbon chain of 3-4 C when $x =$ direct link, or of 2-3 C when $x = \text{O}$; $Z\cdot\text{H}$ is—



and A = sulphonated phenylene, diphenylene or stilbene radical), or with 1 such mol. and 1 mol. of another coupling component capable of metal-complex formation, to give the title dyes. Metallisation, preferably with Cu, may be carried out in substance or on the fibre. Thus benzidine-3,3'-dicarboxylic acid is tetrazotised and coupled with 1 mol. of 3-methyl-1-phenyl-5-pyrazolone and with 1 mol. of the coupling component



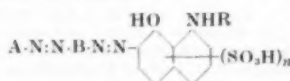
The disazo dye so formed has high fastness to light, washing and application of crease-resist finishes, especially when after-coppered. E.S.

Blue Disazo Reactive Dyes for Cellulose, and their Copper-complexes

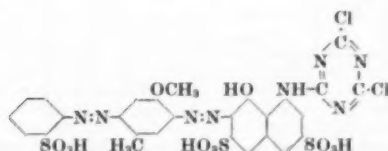
ICI

BP 838,728 (16 Aug 1957)

Aminodisazo compounds



(A = Ar; B = residue of *p*-coupling amine of benzene or naphthalene series; R = H, Alk. or *m*- or *p*-aminobenzoyl; *n* = 1 or 2) or their Cu-complexes, are condensed with 1 mol. of cyanuric chloride to give the title dyes. Thus the aminomonoazo compound orthanilic acid-*p*-residine is diazotized and coupled with H acid under alkaline conditions. Condensing with cyanuric chloride then gives—



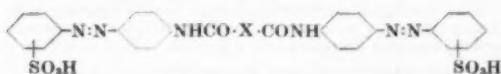
E.8.

Yellow Dyes for Use in Silver-dye-bleach Colour Photography

Gy

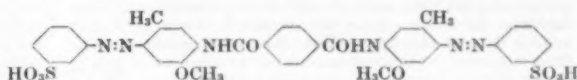
BP 841,300 (9 May 1957)

Symmetrical dyes of formula—



(X = unsatd. aliphatic, aromatic or heterocyclic divalent radical, the connecting valences being on opposite sides of an unsatd. linkage or separated by part of the ring of a ring-containing molecule; the benzene rings may carry

non-ionogenic substituents or the terminal benzene rings each carry one carboxylic group and one hydroxy group), e.g.—



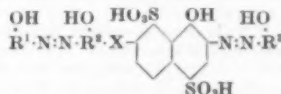
are yellow to reddish yellow dyes suitable for use in silver-dye-bleach colour photography. C.O.C.

Metal(Copper)-complex Dis- and Tris-azo Direct Dyes

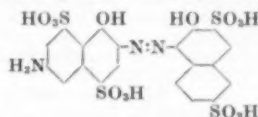
FB

BP 837,996 (Germany 21 Dec 1956)

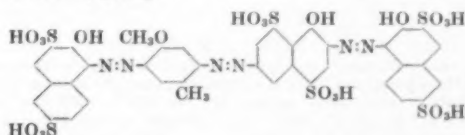
Copper complexes of *oo'*-dihydroxyazo compounds—



(R, R³ = radicals of coupling components; R¹ = residue of benzene or naphthalene series in which X is *para* to the azo link; X = azo, azoxy or NH-Y-NH, where Y = radical of a bifunctional acylating agent) dye cellulose mainly greyish blue. Thus the monoazo compound 6-nitro-2-naphthylamine-4,8-disulphonic acid—R salt is treated with H₂O₂ in presence of CuSO₄, which introduces an o-OH group and gives a Cu-complex, so that warming with aq. Na₂S then gives the aminoazo compound—



This is diazotised and coupled with *p*-cresidine, and the resulting aminodisazo dye is then diazotised and coupled with R salt, giving—



Coppering with demethylation at the CH_3O group gives a greyish blue direct dye. E.S.

Improving the Fastness to Water of Metal Lakes of Sulphonated Azo Dyes

Giv

BP 837,851 (Switzerland 17 July 1956)

Incorporation of 5-15% by weight of a water-soluble aliphatic or cyclic nitrogenous compound which has precipitating action on an aqueous solution of the dye, much increases the fastness to water of the lakes without adversely affecting their colouring properties. Thus addition of the diethylenetriamine-dicyandiamide condensate to the Ca lake of 1-aminobenzene-2,5-disulphonic acid-2-hydroxynaphthalene-3-carboxylic acid-1-naphthylamide results in better fastness to wet rubbing when the lake is incorporated into polyvinyl chloride foil.

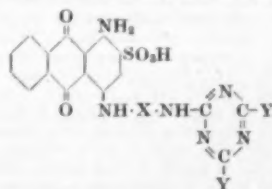
C.O.C.

Reactive Dyes—Water-soluble Anthraquinonoid Compositions

ICL

BP 838,335 (23 March 1956)

The title compounds contain, as free acids or salts—



(X = aromatic bridge, e.g. phenylene, containing ≤ 1 anionic solubilising group, and espec. X = monosulpho-*m*-phenylene diamine residue, Y = Cl or Br) and $\leq 10\%$.

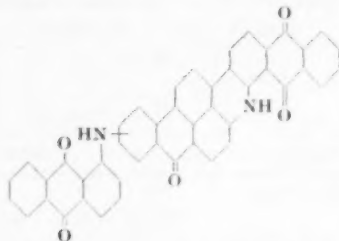
of a solid buffer which has pH 6-8 in aq. soln., e.g. mixtures of alkali-metal salts of H_2PO_4 . They have good stability and give blues to greens of good light fastness and better washing fastness than any previously recorded water-soluble dyes of this type. They may be applied from aq. soln., with treatment with an alkaline agent prior to, simultaneously or after application of the dye. In printing pastes, an alkali precursor (on heating or steaming), e.g. $NaHCO_3$ or Na trichloracetate, may be used. Thus, a soln. of cyanuric chloride (5) in acetone (24) is stirred gradually into H_2O (100) and ice (100), the suspension cooled to 0-4°C. and a soln. of 1-amino-4-(3'-aminoanilino)-anthraquinone-2,4'-disodium sulphonate (13-33) in H_2O (300) added over 1 hr. After stirring 1 hr., the mass is neutralised with 10% Na_2CO_3 and a soln. of anhyd. Na_2HPO_4 (I) (6) and anhyd. KH_2PO_4 (II) (12) in H_2O (100) added. $NaCl$ is added to a conc. of 200 g./l. after 1 hr. and the dye filtered, the cake being washed with a soln. of I (6), II (12), and $NaCl$ (80) in H_2O (400) and dried. It is finally mixed with I (1) and II (2) to give a mixture containing approx. 3.7 buffer and 17 pure dye.

A.T.P.

Anthraquinone Vat Dyes

FBY BP 838,755 (Germany 13 May 1957)

Intense greyish olive to olive-green vat dyes of excellent properties are obtained by halogenation (I) of dyes (II) of general formula—



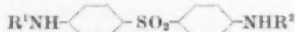
II are obtained by treating anthraquinonyl-Bz-benz-anthrone-carboxylic acid (α -anthraquinonyl) amides with alkaline condensing agents at 100-200°C. (BP 779,508; J.S.D.C. 73 (1957) 523). I is effected at 120-150°C. by, e.g. halogen, SO_2Cl_2 , $ClSO_3H$, in an $AlCl_3$ -based melt, e.g. $AlCl_3/NaCl$ and optionally in presence of catalysts such as I_2 , Fe, S. If 2-100% (preferably 10-40%) of an oxidising agent, e.g. $FeCl_3$ or pyrolysate, is present, the $AlCl_3$ may act as partial or complete halogenating agent. During I, ring closure to what is assumed to be a carbazole or a coaradionine ring occurs.

A.T.P.

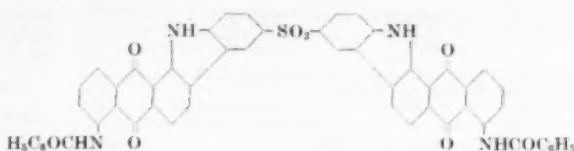
Vat Dyes containing a Diphenyl Sulphone Bridge

General Aniline USP 2,908,684 (13 Aug 1956)

The title compounds (I) are—



(R^1, R^2 = same or different vatable residues) and have excellent fastness to light, washing and chlorine on cotton and a colour range from red-violet to olive-brown to bluish grey. They are obtained by condensing a disubst. diphenyl sulphone, espec. bis-(4-bromophenyl) sulphone (II) with arylamines R^1-NH_2 in a solvent, e.g. nitrobenzene or naphthalene, at 180-240°C., in presence of an acid binding agent, e.g., Na_2CO_3 , Na acetate, and a Cu catalyst. I can also be carbazole under drastic conditions to give fast dyes of slightly yellowish hue. Thus, a mixture of II (18-8), 1-amino-5-benzamidoanthraquinone (III) (34-2), Na_2CO_3 (14), Cu acetate (2) and nitrobenzene (482) is stirred at 200-210°C. for 4 hr. Further Na_2CO_3 (6) and III (4) are added and the mass is heated a further 1 hr. The cold mixture is diluted with ethanol (240), the product filtered and washed with ethanol, acetone and water. The cake is finally stirred in dil. HCl for 1 hr. to give I (R^1 and R^2 = 5-benzamido-1-aminoanthraquinone residues) (IV), which dyes cotton reddish brown of excellent fastness. IV (10) may be heated for 10 min. at 185-195°C. in a melt of $AlCl_3$ (80) and $NaCl$ (20) to give a yellow-brown dye (6) of good fastness to light.



A.T.P.

Naphthoylene Diarylimidazol Vat Dyes

General Aniline

USP 2,908,685 (1 Feb 1957)

Red-brown vat dyes of excellent fastness to chlorine, washing and bleeding are obtained by separating the isomeric mixture obtained by condensing a 1,4,5,8-naphthalene-tetra-carboxylic acid (I) with chloro- or unsubst. *o*-phenylenediamine or toluylene diamine into its *trans* and *cis* isomers and chlorinating or brominating the *cis* isomer. Unchlorinated *cis* isomers have poor washing and bleeding fastness and the dye from I and 4-chloro-*o*-phenylenediamine—



has poor washing fastness, so halogenation as above is presumed not to occur in rings A unless the halogen atoms are not in the same position as they would be introduced in condensations from I direct.

A.T.P.

Rendering C.I. Pigment Red 90 Resistant to Bronzing on Heating

Sterling Drug Co.

BP 836,921 (U.S.A. 7 June 1956)

Addition to the lead salt of 2,4,5,7-tetrabromo-3,6-fluorandiols (C.I. Pigment Red 90) of small amounts of (a) rosin amines and (b) Acid Alizarin Red B (C.I. Mordant Red 9), Violamine B (C.I. Acid Violet 30) or a halogeno-3,6-fluorandiols, e.g. C.I. Acid Red 91 or 92, prevents it bronzing upon being heated, e.g. when used in heat-set printing inks.

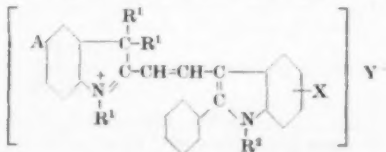
C.O.C.

Dyes for Acrylonitrile Fibres

FBY

BP 840,282 (Germany 28 March 1957)

Polymers and copolymers of acrylonitrile or *as*-dicyanoethylene are dyed with excellent light fastness by dyes—



(A = alkoxy, hydroxyalkoxy, carboxylic acid alkyl or hydroxyalkyl ester, R^1 = Alk, R^2 = H or Alk, Y = acid radical, X = H or non-ionic radical, e.g. Hal, Alk or alkoxy. Their preparation and application are by any of the standard known methods, e.g. as in GP 865,925. Thus, the dye where A = OCH_3 , R^1 = R^2 = CH_3 and X = H, from 1-methyl-2-phenylindole-3-aldehyde and 5-methoxy-1,3,3-trimethyl-2-methyleneindoline, yields brilliant red-orange dyeings of excellent fastness to light. Numerous other examples are given, all yellow to orange.

A.T.P.

β -Phase Phthalocyanine Pigments

DuP

USP 2,908,690 (29 Nov 1955)

Phthalocyanines in the β -phase (I) (FIAT, 3, 1313, and USP 2,556,726) of improved tinctorial strength and brightness are obtained by salt milling with an inorganic salt (4-20), e.g. $NaCl$, a phthalocyanine (I) capable of

existing in the β -crystal phase, e.g. Cu phthalocyanine (C.I. 74160), at 100–140°C. for 12–24 hr. in presence as crystallising solvent of sufficient nitrobenzene, unsubst. or chlorinated hydrocarbon of b.p. 50–220°C., espec. tetrachloroethylene, to permit the grinding mass to remain as a dry powder. Solvent and salt are finally removed and I isolated. I are greener, stronger and more intense than are previously known phthalocyanine pigments. They are very suitable for multi-colour or process printing, where their properties enable them to be used in place of the Peacock Blues. Thus, β -Cu phthalocyanine (II) is obtained from II (I), NaCl (8-65) and tetrachloroethylene (9). A.T.P.

Cobalt Phthalocyanine Vat Dyes

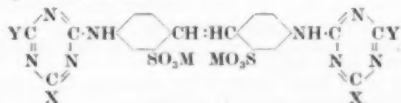
General Aniline USP 2,908,544 (30 Dec 1954)

Co phthalocyanine (I) is converted into vat dyes of improved solubility by treatment, preferably at 70–100°C., with HCHO or its precursor (preferably 0.3–1 equiv./mole of I) in presence of a strong acid of < 90% conc., e.g. methyl sulphuric acid, H_2SO_4 , or H_3PO_4 , and optionally in presence of 5–40% (on wt. HCHO) of an amide, e.g. formamide or acetamide. The products, which contain unchanged I, are superior to I and are vatiable in weak alkali, e.g. NH_4OH , making them suitable as vat dyes for wool and wool-synthetic fibre blends. They are bright blues of excellent light fastness; redder blues result if an amide is present in the condensation. Thus I (5) is dissolved in 100% H_2SO_4 (7), allowing temperature to rise to 39°C. With cooling, acetamide (0.6) and paraformaldehyde (2.6) are added and the mass heated at 70–75°C. for 1 hr. before drowning into water (1500) and filtering. The product dyes cotton clear blue of excellent light fastness. A.T.P.

Diaminostilbene Disulphonic Acid Derivatives—Fluorescent Brightening Agents

S BP 838,271 (Switzerland 20 Sept 1957)

Compounds of formula—

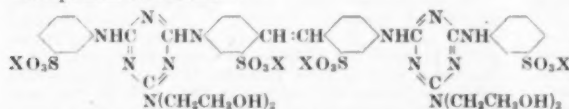


(X = Hal; Y = primary or secondary monohydroxy-alkylamine of 3–5 C; M = H or cation), e.g. 4,4'-bis-(2- γ -hydroxypropylamino-4-chloro-1,3,5-triazolyl)-(6-amino)-stilbene-2,2'-disulphonic acid, are fluorescent brightening agents of good fastness to light and washing. They are particularly applicable to nylon, wool and silk but are also useful on cellulose fibres. C.O.C.

Bis-triazinylaminostilbene Fluorescent Brightening Agents

FBY BP 841,189 (Germany 30 July 1957)

Compounds of formula—

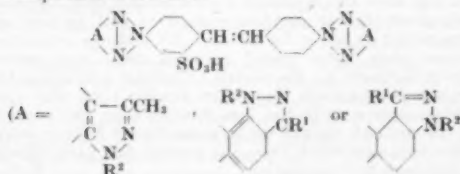


(X = H or cation) have strong bluish fluorescence. They are especially suitable for use with spinning masses of polyesters, polyamides, polyacrylonitriles, and with plastics, resins, lacquers, soaps, and leather. They are very soluble in water and are insensitive to hardness, rosin sizes and alum. They can therefore be used for sized paper even in an aqueous liquor at pH 3–4. Their fastness to light is very good. C.O.C.

Triazolylstilbene Fluorescent Brightening Agents

HW BP 835,779 (1 Feb 1957)

Compounds of formula—

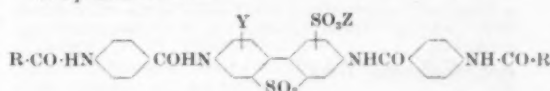


(R^1 and R^2 = same or different. H or subst. or unsubst. hydrocarbon), e.g. 4,4'-bis-(1'''-phenyl-3'''-methyl)-pyrazolo-(4'',5'',4''',5''')-triazolyl]-stilbene-2,2'-disulphonic acid, have good greenish blue fluorescence and fastness to bleaching agents. They have good affinity for cellulose and markedly better affinity for wool than most agents of this type. C.O.C.

Fluorescent Brightening Agent

General Aniline USP 2,911,415 (30 Mar 1956)

Compounds of formula—



(R = Alk, alkoxy, amino or mono- or di-alkylamino; Y = H or SO_3Z ; Z = H, alkali metal or alkaline earth metal), e.g. the product obtained by acetylating 3,7-bis(amino-benzoyl)dibenzothiophenedioxide-2,8-disulphonic acid, have excellent blue fluorescence free from any trace of green or pink. They are very suitable for use with textiles, paper and in discharge printing pastes. C.O.C.

Indenothiazoles—Intermediates for Cyanine Dyes

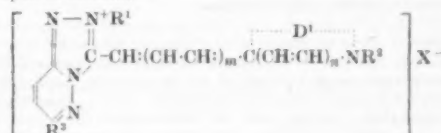
Sperry Rand Corp. USP 2,912,434 (22 Aug 1955)

Condensing 2-bromoindanone with thioacetamide and thioformamide respectively yields 2-methyl-(2,1d)indenothiazole and (2,1d)indenothiazole respectively. Their quaternary salts condense readily with appropriate compounds to form cyanine dyes, thus 2-methyl-(2,1d)-indenothiazole ethiodide refluxed with 2- β -acetanilido-vinyl benzoxazole ethiodide in absolute alcohol and in presence of triethylamine yields the green 3,3'-diethyl-8'-(3-ethyl-2(3)-benzoxazolylidene)ethylidene]oxa-(2',1d)-indenothiazole carbocyanine iodide. C.O.C.

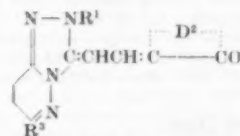
Cyanine Dyes containing a Triazaindolizine Ring System

Ilford BP 839,020 (11 July 1957)

Dyes of formula—



and

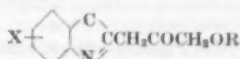


(R^1 and R^2 = same or different Alk; R^3 = Alk or Ar; m and n = 0 or 1; D^1 = atoms to complete a 5- or 6-membered ring; D^2 = atoms to complete a keto-methylene nucleus; X = acid radical) e.g. the yellow (2,6-dimethyl-1,2,3,7-triazaindolizine) (3-methyl-2-benzothiazole) mono-methincyanine iodide, have photosensitising properties. C.O.C.

Cyanine Dyes

Ilford BP 835,275 (16 Nov 1956)

Methin cyanine dyes are obtained by treating a compound of formula—

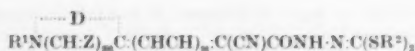


(R = Alk, Ar or aralkyl; X = H or one or more Hal, hydrocarbon, alkoxy or fused benzene groups) with heterocyclic compounds containing thioether, thioether vinyl or acetanilidovinyl groups. Thus 2-ethoxyacetoxyl-benzothiazole refluxed with 2-methylthiobenzothiazole in alcohol in presence of triethylamine yields the yellow 2-[α -(2-benzothiazolyl)- α -(ethoxyacetyl)methylene]-2,3-di-hydro-3-methylbenzothiazole. C.O.C.

Hemicyanine Dyes

Ilford BP 840,384 (12 Mar 1957)

Dyes of formula—



(m and n = 0 or 1; Z = CH or N; D = atoms to complete a 5- or 6-membered ring; R^1 = Alk, aralkyl, hydroxyalkyl or carboxyalkyl; R^2 = Alk, aralkyl or alkoxyalkyl, e.g. the orange 1- α -cyano- γ -(3-ethyl-2,3-dihydro-2-benzothiazolylidene)crotonol-2-bis(methylthio)-methylenediazine obtained by dissolving 1-cyanoacetyl-2-bis(methylthio)methylenediazine and 2,2'-acetanilidovinylbenzothiazole ethiodide in hot ethanol and then adding triethylamine, have photosensitising properties.

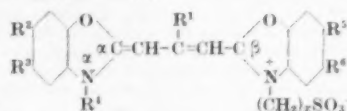
C.O.C.

Anhydrocyanine Dyes

ICI

BP 840,223 (10 July 1957)

The title compounds (I)—



(R^1 and R^2 = alkyl, other R 's = H, Hal, Alk, Ar or alkoxy, or R^3 and R^4 and/or R^5 and R^6 may be joined in a benzene ring; x = 1 or 2) are obtained by treating the N -alkyl quaternary salts (i.e. where α -C is subst. by CH_3 and α -N by R^1 and an acid radical) with an anil (i.e. where β -C is subst. by $-\text{CH}=\text{C}(\text{R}^2)\text{NHPh}$). I are thus obtained in better yield than by previously recorded methods (e.g. BP 654,690, J.S.D.C., 67 (1951) 390). Thus, the reaction product of 2-methyl-5-phenylbenzoxazole and bromoethane sulphonic acid is treated with 8-ethyl-isothiopropanilide and the resultant compound condensed with 2-methyl-5-phenylbenzoxazole ethiodide to give I, where x = 2, R^2 and R^5 = H, R^3 and R^6 = C_6H_5 and R^1 and R^4 = C_3H_7 .

A.T.P.

Cyanine Dyes containing a 6,7-Dihydro-5-*H*-thiopyrano(3,2d)thiazole Nucleus

Sperry Rand Corpn.

USP 2,912,433 (27 Apr 1956)

Cyanine dyes in which one or both of the auxochromic N atoms lies in a 6,7-dihydro-5-*H*-thiopyrano(3,2d)-thiazole nucleus are obtained by converting 2-alkyl-6,7-dihydro-5-*H*-thiopyrano(3,2d)thiazoles into quaternary salts and then treating with an intermediate for a cyanine dye, e.g. with 2-halogeno quinoline quaternary salts in presence of an acid binding agent to yield pseudocyanine dyes. Thus 2-methyl-6,7-dihydro-5-*H*-thiopyrano(3,2d)thiazole ethiodide refluxed with 2-iodoquinoline ethiodide in presence of triethylamine and absolute alcohol yields the red 1,1'-diethyl-6,7-dihydro-5-*H*-thiopyrano(3,2d)thiazolo-2'-cyanide iodide.

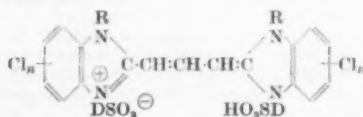
C.O.C.

Anhydrocyanine Dyes

Eastman Kodak Co.

USP 2,912,329 (23 Aug 1957)

Dyes of formula—



(R = Alk; n = 1 or 2; D = alkylene, e.g. the red anhydro-5,5',6,6'-tetrachloro-1,1'-diethyl-3,3'-di(4-sulphobutyl)-benzimidazolocarboaniline hydroxide, give excellent green sensitisation without undesirable fog to photographic emulsions containing colour couplers.

C.O.C.

Carbon Black (C.I. Pigment Black 6 and 7)

Godfrey L. Cabot

USP 2,911,287 (13 Feb 1957)

Gaseous or vaporised hydrocarbon is passed across a direct-flame-heated refractory surface quickly enough to prevent substantial deposition of the pigment on the surface so that all the pigment formed can be recovered from the exhaust gases. This results in appreciably higher yields than have hitherto been possible.

C.O.C.

Carbon Black (C.I. Pigment Black 6 and 7)

Phillips Petroleum Co. BP 837,804 (U.S.A. 20 June 1955)

Describes apparatus for producing the pigment from a viscous hydrocarbon oil.

C.O.C.

Carbon Black (C.I. Pigment Black 6 and 7)

Esso Research & Engineering Co.

BP 838,009 (U.S.A. 3 June 1957)

The pigment is attrited by heavy ball-milling or rolling between tight steel rolls or supersonic vibration or jet impact, in presence of an oxygen-containing gas, until it

has X value > 75 when $X = \frac{2000 + 100A}{\text{pH} \times S}$ (A = area in

acres/lb.; S = gallons of oil adsorbed/100 lb. pigment). The product is especially useful in rubber compounding.

C.O.C.

Carbon Black (C.I. Pigment Black 6 and 7) Pastes

N.V. De Bataafse Petroleum

BP 841,017 (Holland 17 June 1957)

The Carbon Black-containing mixture obtained in the scrubbing of gases formed during the incomplete combustion, cracking or gasification of carbonaceous material, when mixed with a binder, is suitable for making printing inks and for other pigmentary purposes.

C.O.C.

Titanium Dioxide (C.I. Pigment White 6)

Laporte Titanium

BP 835,880 (26 April 1956)

Titanium ore containing iron as the main impurity, e.g. ilmenite, is heated with a reducing agent, e.g. coke, and then the iron is dissolved out by treatment at $< 70^\circ\text{C}$. with sulphuric acid obtained from the hydrolysis of titanium sulphate. This has the advantage over ordinary sulphuric acid that some of the Ti present in the acid is precipitated as TiO_2 during the dissolution and so recovered. Further, when the ore is heated with a reducing agent there is generally formed an oxide of titanium that is slightly soluble in cold sulphuric acid but by the present process this loss of titanium is either eliminated or greatly reduced.

C.O.C.

Whiting (C.I. Pigment White 18): Particle Size and Surface Adsorption in relation to Oil Adsorption Value (V p. 565)

Dyeing Wool with Reactive Dyes Containing Halogeno-s-triazine Groups (VIII p. 570)

mm-Dioxyphenols as Diazotype Coupling Components (IX p. 570)

6-Amino-8-hydroxyquinolines as Coupling Components for Azine Dye Images (IX p. 571)

V—PAINTS; ENAMELS; INKS**Monomer-modified Epoxy-drying Oil Resins**

L. Kovacs and J. Zarb

J. Oil & Col. Chem. Assoc., 43 (May 1960) 350-354

An oil-modified epoxy resin was prepared by heating dehydrated castor oil (1 pt. by wt.) with a conventional epoxy resin (1 pt. by wt.) in presence of 1% maleic anhydride until the viscosity of a 60% solution in xylene reached 50 poise at 25°C . This resin (1 pt. by wt.) as a 60% solution in xylene was refluxed at 130 – 140°C . for 7 hr. with styrene (1 pt.) and xylene (to total 3 pt.) while *t*-butyl hydroperoxide (0.4% on total wt.) was added slowly. Alternatively 20% of the styrene was replaced by either ethyl or ethylhexyl acrylate. Experimental evidence suggests copolymerisation occurred with $> 5\%$ monomer remaining after 6 hr. The viscous solutions were diluted to 30% solids content with a mixture of xylene and methyl ethyl ketone and each was then mixed (equivalent of 3 pt. as solids) with a butanol-modified melamine-formaldehyde resin (equivalent of 1 pt. as solids) and coatings deposited on steel and tinplate by doctor knife both directly and after pigmentation with rutile titania (100% on solids). Coatings were also deposited from a control resin prepared without styrene or acrylate monomers and all coatings were stored at 150°C . for 30 min. All coatings containing styrene gave higher pencil hardness than, but similar scratch hardness to, the control. Coatings containing the acrylate comonomers were more flexible than that containing styrene only but less flexible than the control. All the coatings showed better resistance to boiling water, dilute acid and alkali than the control but were inferior in gloss and flow properties.

E.C.

Whiting (C.I. Pigment White 18): Particle Size and Surface Adsorption in relation to Oil Adsorption Value

R. R. Davidson

J. Oil & Col. Chem. Assoc., 43 (May 1960) 307-349

Following a review of the literature (41 references) on the Oil Adsorption Value (OAV: ml. of oil to bind 100 g. powder) of powders and its relation to void volume, degree of flocculation and surface adsorption, results of a study of the OAV of whiting under various conditions are reported. Mixtures of whiting with varying amounts of rutile titania show a minimum in OAV at a certain composition compatible with the view that the titania fills the free space between the larger whiting particles and OAV is dependent on the free space in the packed powder. Mixing of stiff pastes of whiting in water containing a surface-active agent in a blade mixer causes a small reduction in particle size and gives a whiting (after washing and drying) with a slightly lower OAV determined with an acid-refined linseed oil. Ball-milling in water up to 155 hr. leads to a significant size reduction and a slight increase in OAV. Surface adsorption effects were examined by determining OAV with an alkali-refined linseed oil (acid value < 0.1) containing linseed oil fatty acids (up to 5%) which led to a fall in OAV (from 23 to 20). Using 10% solutions of various alkyl resins in dibutyl phthalate, OAV increased (from 23 to 29) with the molecular complexity of the alkyl resin. Similar but more marked effects were noted with whiting in xylene (OAV 80) on adding 10% alkyl resin (OAV 26) due to the flocculent nature of the dispersion in pure xylene.

Experiments in a blade mixer simply adapted to measure the torque applied in paste mixing showed that the torque developed in mixing whiting with linseed oil containing the corresponding fatty acids rises to a maximum over 20 min., at which point a single mass of paste is obtained, and then falls slowly to a lower value. Pre-treatment of the whiting with fatty acids reduces the mixing time required to form a paste. Studies of "wetting time" based on the time required for a drop of oil to penetrate a thin layer of whiting deposited on glass from aqueous suspension show that addition of fatty acids to linseed oil does not accelerate wetting; hence it is inferred that the shorter mixing times obtained in presence of fatty acids are not due to faster wetting. The fall in consistency on continued mixing is attributed to a reduction in void volume.

Using dibutyl phthalate as the main liquid phase and adjusting the amount to achieve a fixed torque in the blade mixer, addition of fatty acid leads to a lower demand of liquid phase whereas addition of an alkyl resin leads to the converse. In general, whiting shows a low OAV in liquids containing fatty acids and a major increase in liquid volume is needed to reach the point at which the dispersion flows. Conversely, in liquids containing alkyl resin a higher OAV is obtained but only a moderate increase in liquid volume is needed to reach the flow point. Experiments on the spreading of dibutyl phthalate containing fatty acids and/or alkyl resin on a specially prepared calcite surface suggest that the initial spreading which occurs is followed by a process of reorientation in which adsorbed layers are reduced in thickness. The higher OAV of liquids containing alkyl resin is attributed to the thicker adsorbed layer which is formed.

An attempt is made to explain the results reported in terms of various theories of surface activity but only tentative conclusions are reached. The significance of the results in determining pigment selection, binder requirements and consistency change and sedimentation during storage are briefly mentioned. Notes on discussion of the paper are also included.

E.C.

Surface-active Agents as Flow-control Additives in Emulsion Paint

W. F. Scheufele

Off. Dig. Fed. Soc. Paint Technology, 32 (May 1960) 748-761

Efficiency of pigment dispersion, brushability, surface wetting, foaming, flooding or floating, and even film-forming characteristics of emulsion paints depend in different degrees upon the flow properties; these in turn are governed by the surfactants present. Available types of surfactant are reviewed and, as far as possible, their effect upon flow properties is indicated. Surfactants are

specific in their effect and must be correctly chosen to give the optimal effect in any given paint. Advantage may be taken of special flow properties imparted by certain surfactants to produce novel surface effects in metallic pigmented emulsion coatings; these are shown in photographs.

J.W.D.

Water-soluble Thickeners as Flow-control Additives

H. L. Jaffe

Off. Dig. Fed. Soc. Paint Technology, 32 (May 1960) 706-721

The evaluation of 11 water-soluble thickeners in paints made from polyvinyl acetate, acrylic, and styrene-butadiene emulsions is reported. Results are tabulated and there are 24 rheological graphs.

J.W.D.

Effect of Metallic Soaps on the Flow of Paint

F. J. Licata

Off. Dig. Fed. Soc. Paint Technology, 32 (May 1960) 735-747

Six metallic soaps were evaluated in paint formulations based upon mineral spirits, bodied linseed oil, and an alkyl; each was studied also in a complete flat paint formulation. Dispersions were made at 80°F. and 200°F. Metallic soaps aid greatly the suspension of the pigments, which in turn governs the flow characteristics of the paint. They contribute also to thixotropy in the paint to a degree depending on the extent of solvation of the soap in the vehicle, and the nature of both the soap and the vehicle.

J.W.D.

Water-insoluble Flow Agents for Paints

T. C. Patton

Off. Dig. Fed. Soc. Paint Technology, 32 (May 1960) 722-734

Additives for the control of paint flow properties include: (i) water, with or without soap or other surfactant, to modify pigment flocculation; (ii) oils bodied just short of gelation, to raise the average vehicle viscosity; (iii) metallic soaps which form semi-rigid gels; (iv) acidic materials which form soaps *in situ* with basic pigments; (v) silica pigments to provide the effect of a flocculated structure, and (vi) additives which swell in the vehicle to give a colloidal structure having thixotropic properties. The purposes of such additives are listed, the mechanisms by which they fulfil them are discussed, and the advantages and disadvantages of each type of additive are enumerated. By far the most effective and universally applicable are the modern additives of type (vi).

J.W.D.

Flow Properties in Applications of Aqueous Coatings

B. S. Garrett

Off. Dig. Fed. Soc. Paint Technology, 32 (May 1960) 690-705

Viscosity control in compound latexes involves interaction of the water-soluble thickener with the dispersed solid particles to form loose aggregates. Extent of viscosity increase is specific to the latex-thickener pair. Viscosity of the system depends sharply on solids concn., for which there is a critical value. Structure or yield stress also exists in these systems, becoming more important with increasing concn. of thickener and latex solids. Latex or emulsion paints exhibit similar behaviour with the added complications resulting from the addition of dispersed inorganic pigment phases. Many such paints are formulated at a solids concn. just below the critical value at which viscosity and yield stress increase rapidly with water loss. In formulating a good levelling paint time must be allowed for levelling to take place before plasticity develops. The most significant loss of water is that due to wicking into the porous substrate. Formulation studies suggest that good levelling is best secured with low solids and high thickener levels; this is restricted by loss of scrub resistance and low total paint solids. Good levelling probably depends upon the discovery of a thickener that will effectively raise aqueous viscosity with min. interaction with dispersed solid particles.

J.W.D.

Effect of Flow Properties in Paint Production on Roll Mills

A. C. Zettlemoyer and J. H. Taylor

Off. Dig. Fed. Soc. Paint Technology, 32 (May 1960) 648-661

A theory based on constant viscosity hydrodynamics has been developed to predict the rate of flow between rotating cylinders of a roll mill from knowledge of the fluid viscosity, roll speed and size, and force applied to the rolls. Relative transfer of fluid between rolls may be predicted as a function of roll-speed ratio. Both theories are confirmed by practical results when fluid viscosity is constant, but there are deviations from theory if the

viscosity varies as the result of shear, because of either local temp. rise or thixotropic behaviour. The relation between fineness of grind and mill throughput is discussed. Throughput may often be improved by arranging roll-cooling to give a temp. gradient from back to front of a mill. J.W.D.

Effect of Flow Properties of Aqueous Products on Paint Production

E. E. Baumhart *Off. Dig. Fed. Soc. Paint Technology*
32 (May 1960) 662-667

Summary of the effect of flow characteristics in the three phases of paint manufacture: (i) withdrawal of raw materials from storage; (ii) manufacture, dispersion, and mixing; (iii) filling and packaging. Developments of suitable additives might obviate the need for variety of equipment required for handling products of different flow characteristics. J.W.D.

Effect of Flow Properties on Application of Non-aqueous Systems

W. K. Aabeck *Off. Dig. Fed. Soc. Paint Technology*,
32 (May 1960) 668-689

Brushability of a paint, with which the first section of the paper is concerned, is determined by the high-shear viscosity of the system; this in turn is influenced by the amounts and types of solvents used; binder viscosity; concn., size-distribution and shape of pigment particles; and temp. These factors and their quant. interaction are discussed. Theory and practical difficulties in high-shear viscosity measurement are also discussed. In the second part of the paper there is a brief review, with two photographs and a diagram, of different types of viscometer, with special reference to measurements at high rates of shear. A simple viscometer has been devised to make measurements at shear rates up to ca. 22,500 sec⁻¹; this is described with the aid of a photograph. Measurements correlate well with those made with a self-centring rotational viscometer, and with actual brush-out tests; it is not necessary to thermostat the measuring surfaces of the new instrument—the "brushometer". J.W.D.

Résumé of some Highlights of the Symposium on the Viscosity and Flow Properties of Paints

E. G. Bobalek *Off. Dig. Fed. Soc. Paint Technology*,
32 (May 1960) 778-781

Effect of Surface-active Agents on Flow Properties of Non-aqueous Systems

E. Singer *Off. Dig. Fed. Soc. Paint Technology*,
32 (May 1960) 782-777

No one surfactant is equally effective in either increasing or decreasing the flow characteristics of all pigmented non-aqueous systems; in general, mixtures are more effective than single agents but even these are not invariably effective. Surfactants are selective in action with respect to both pigments and vehicles. With a correctly chosen surfactant it is possible to grind higher concn. of pigments. Stronger tinting colours may thus be made with decrease in production time and/or improvement in grind. Improved levelling and flow characteristics can be obtained with previously difficult coatings, such as semi-gloss enamels, by the use of surfactants. J.W.D.

Measurement of Flow Properties in the Coatings Industry

M. W. Westgate *Off. Dig. Fed. Soc. Paint Technology*,
32 (May 1960) 616-628

Nine types of viscometer are described and discussed with the aid of nine photographs and a diagram. Relevant ASTM and Federal specifications are listed and discussed. Five viscosity conversion aids are listed and described briefly. J.W.D.

Instruments to Measure Flow Properties of Printing Inks

A. C. Zettlemoyer *Off. Dig. Fed. Soc. Paint Technology*,
32 (May 1960) 614-615

A brief review under the headings: Viscometers and Tack Instruments. J.W.D.

PATENTS

Dyes for Hectograph Inks and Masses

BASF *BP 835,703* (Germany 21 July 1955)

Mixtures of at least two complexes, each formed by reaction of equimolecular proportions of a diarylmethane,

triarylmethane, acridine, xanthene or thiazine basic dye with a chrysoidine or fuchsine basic dye, are used. Thus a mixture of the following complexes Crystal Violet (C.I. Basic Violet 3) + Chrysoidine B (C.I. Basic Orange 2) (54 parts by wt.), Victoria Blue B (C.I. Basic Blue 26) + Chrysoidine B (14), Malachite Green BBN (C.I. Basic Green 4) + Chrysoidine B (22), and Auramine O (C.I. Basic Yellow (2) + New Fuchsine (Basic Violet 2) (10) used in a hectograph mass will yield a large number of deep black copies, there being no variation in hue from first to last. C.O.C.

Pigment Pastes

Gy *BP 841,519* (7 July 1955)

When organic pigments are dispersed in a liquid non-ionic surfactant in substantial absence of water, products of high pigment content and very fine dispersion are obtained which are very compatible with both aqueous and non-aqueous systems. C.O.C.

Pigment Dispersions

General Aniline *BP 835,637* (USA 15 Nov 1956)

Dispersions of organic pigments are readily obtained by kneading an aqueous paste of a pigment, e.g. an aqueous press cake, with a vinyl polymer, e.g. a polymeric N-vinyl pyrrolidone. The ratio of pigment to polymer must be at least 1:1 and not more than 10:1. The resulting dispersions are particularly suitable for pigmenting oleoresinous systems or aqueous systems. Under all circumstances the final pigmented product no longer shows water sensitivity despite the fact that it may contain sizeable amounts of an originally water-soluble material. C.O.C.

Dispersing Pigments in Vinyl Chloride Resins

Union Carbide Corp. *USP 2,913,432* (27 Dec 1956)

Carboxylates of Si, Sn and Pb and the aminoalcohol and polyhydric alcohol derivatives of Si, Sn, Pb and Zr, e.g. dibutoxy-di-(triethanolamine) silicate-N,N-dioleate, are excellent agents for dispersing pigments in vinyl chloride polymers. They have the further advantage that their use results in coatings of improved gloss and hiding power and of better fastness properties without need for stoving. C.O.C.

Oil Gels

Hardman & Holden *BP 835,874* (2 Jan 1956)

Natural oils and fats (with or without fatty acids or other carboxylic acids, resinous or synthetic polymers) are treated at 15-300°C. with Al acylates or polymers thereof, alkoxy- or phenoxy-aluminium acylates or polymers or condensates thereof, polyoxo-aluminium alkoxides, polyoxo-aluminium phenoxides or polyoxo-aluminium alkoxide-phenoxides. The products are suitable as printing ink media, or for dilution with conventional thinners to yield paint media of improved pigment suspension and anti-penetrating properties. C.O.C.

Thixotropic Oils

FBy *BP 840,830* (Germany 2 Feb 1957)

Thixotropic oils are very easily produced by inter-esterifying 1 mol. of a drying or non-drying oil with 0.5-2.5 mol. of a polyhydric alcohol in presence of a catalyst and treating the product with an amount of a di-isocyanate equivalent to the free OH groups present. The alcohol and/or the di-isocyanate have symmetrical molecules. C.O.C.

Basic Nickel Carbonate (C.I. 77779)—for Improving the Durability of Paint and Lacquer Films

DuP *USP 2,913,348* (21 Aug 1958)

Use of a small quantity of the green basic nickel carbonate (ratio of Ni to CO₃ 1.5-1.7) greatly improves the durability of films obtained by use of alkyd resins, oleoresinous varnishes and cellulose esters. Preferably there are 15-35 parts of carbonate per 100 parts of film-forming material. It may be used alone or in combination with other pigments. C.O.C.

Rendering C.I. Pigment Red 90 Resistant to Bronzing on Heating (IV p. 562)

Carbon Black (C.I. Pigment Black 6 and 7) Pastes (IV p. 564)

VI—FIBRES; YARNS; FABRICS

Effects of γ -Radiation on Cotton Cellulose

J. C. Arthur, F. A. Blouin, and R. J. Dewint

Amer. Dyestuff Rep., 49 (30 May 1960) 383-388
The major structural changes caused in cotton cellulose exposed to γ -radiation at several dosage levels ranging up to 100,000,000 roentgens were formation of carbonyl and carboxyl groups and cleavage of the cellulose molecule. The fibrous structure disintegrated at dosages > 5 -10 million roentgens with loss of textile properties.

C.O.C.

Changes in Fine Structure and Mechanical Properties Induced by Cyanoethylation of Cotton Yarn. Part I—Treated without Tension

C. M. Conrad, D. J. Stanonis, P. Harbrink, and J. J. Creely

Text. Research J., 30 (May 1960) 339-348
Cotton yarn was impregnated with 6% NaOH and treated while relaxed with acrylonitrile at 60°C. for various periods up to 60 min. to give products having up to 2.6 cyanoethyl groups per anhydroglucose unit. As substitution increases, the X-ray diffraction pattern shows only slight alteration until substitution exceeds 1.1, after which the crystalline structure rapidly becomes amorphous, completely so at about DS = 2.0. Simultaneously density decreases nearly linearly with substitution. When the product becomes essentially amorphous it can be annealed at about 175°C. into a new pattern characteristic of cyanoethylcellulose. This annealing is accompanied by substantial increase in density. Stress relaxation of the cyanoethylated yarn at a substitution of 1.1 suggests a glass-rubber transition point about 140°C. which becomes more distinct and moves to lower temperatures as substitution increases. At a substitution of about 2.0 stress relaxation reaches its minimum (about 4% of its value at 20°C.) at the highest temperatures used (220°C.). With further substitution minimum relaxation at an intermediate temperature is followed by increasing stress as the temperature is raised. This effect is associated with crystallisation. Breaking strength increases slightly at low substitutions but decreases then to $< 50\%$ for the highest substitutions. Elongation at break increases gradually, being $> 100\%$ above the control at DS < 2 . Tensile stiffness decreases to about 3% of its initial value. Work of rupture and recovery show considerable decreases at DS < 2 but sharp rises at 2.0-2.6. Immediate elastic recovery is little affected at DS < 2 but rises above this. Delayed elastic recovery shows continuous improvement as substitution increases, eventually exceeding the control by nearly 50%.

C.O.C.

Chemistry of Xanthates and Viscose

K. V. Levitskaya, P. T. Pastukhov, and S. N. Danilov

X—Temperature-dependent Distribution of Carbon Disulphide in Viscose

Zhur. priklad. khim., 33 (April 1960) 890-896
Effect of temp. on the distribution of CS₂ in different stages of the production of viscose has been investigated. Increase in temp. of "pre-ageing" (up to 35°C.), xanthation (up to 30-40°C.), and mercerisation (up to 40°C.) does not yield more favourable distribution of CS₂. In the latter case 6-8% more xanthate is formed. Lowering the temp. of xanthation to 10-12°C. decreases both the amount of by-products and the degree of xanthation. Heating of viscose, after dissolution, to 35-40°C. for 1.5 hr. renders it suitable for fibre manufacture and avoids prolonged ripening.

XI—Effect of Redox Agents on the Properties of Viscose

Ibid., 896-902
The effect of admixed oxidising (NaClO, K₂S₂O₈, Na₂O₂) and reducing (Na₂SO₃) agents on η , degree of ripening, and the distribution of CS₂ between xanthate and by-products has been investigated. Addition of NaClO to viscose immediately after the dissolution of the xanthate decreases the amount of titratable sulphur by 71%, and increases η almost two-fold. Apparently cellulose dioxanthates are formed which cleave readily in alkaline medium, accelerating ripening of viscose. Addition of K₂S₂O₈ (1-3% on the wt. of viscose) decreases the amount of xanthate sulphur by 20%, lowering η slightly; on the other hand, addition of K₂S₂O₈ to alkali cellulose leads to considerable oxidation of cellulose. Addition of

5% Na₂O₂ (on wt. of α -cellulose) before, and immediately after, the dissolution of xanthate increases η but decreases total titratable sulphur.

G.J.K.

Evaluation of Viscose Pulp with regard to the Brightness of Viscose Yarns obtained therefrom

H. Sihtola, E. Kaila, G. Wigren, and B. Hackman

Paperi ja Puu, 42 (Special issue, April 1960), 259-262 (in English)

Cellulose was pptd. from viscose by acid as finely divided flocks, desulphurised, washed, dried and pressed into tablets at 500-1000 kg./sq.cm. Comparative experiments were made with 4 pulp samples by 2 laboratory plants and 2 pilot plants. Brightness was measured on the original and the mercerised sheet, on cellulose pptd. from viscose and on viscose rayon filament, staple fibre, and cloth. The order of the pulps varied according to the method used, even measurements on yarn made in various ways gave contradictory results. It is impossible to say which method gives the most reliable results, but because of its simplicity brightness measurements on the mercerised sheet may be regarded as most suitable.

R.A.

Dynamics of Textile Materials. IV—Non-linear Viscosity of Wool Fibres

K. Shirakashi and N. Oguchi

J. Soc. Textile Cellulose Ind. Japan,

15 (July 1959) 548-551

The usual second-order differential equation of motion is generalised to include the fact that the viscosity term for wet wool fibres varies with extension. In water at 25°C. the relative viscosity (RV) increases sharply to more than 146% at 3% extension but then falls to a limiting value of $\sim 65\%$ from 20 up to 40% extension. In 7% phenol solution at 25°C. there is an immediate drop of RV at zero extension to 59% of what it was in water. It first decreases to a minimum of $\sim 25\%$ at 20% extension and then increases to over 60% when 40% extension is reached. The relative Young's Modulus of fibres (RY) in water at 25°C. falls to a minimum of $\sim 30\%$ at 20% extension but partially recovers to 70% when 40% extension is reached. In the phenol solution, RY is 18% at zero extension, falling even further to $\sim 5\%$ at 10% extension but then increasing to $\sim 45\%$ at 40% extension.

L.P.

Reaction of Wool with Oxidising Agents in Concentrated Salt Solutions

J. R. McPhee *Text. Research J.*, 30 (May 1960) 349-357

Concentrated salt solutions protect wool against oxidative degradation. Oxidising agents result in lower felting power in concentrated salt solutions than in absence of salt. Many oxidations, followed by reduction, reduce the felting power of wool more than either alone. Results are given which confirm that attack on disulphide bonds is the only primary action during chemical shrink-resisting and that attack at some other point of the protein structure need not occur. However, breaking of disulphide bonds is insufficient in itself to reduce the felting property and the exact nature of the chemical change leading to loss of felting power is unknown. No conclusive evidence is available to decide whether or not changes in frictional properties are the general cause of loss of felting power. Where swelling is less than in simple aqueous solutions, reaction still occurs through the fibre rather than only at the surface. The results obtained do not agree with theories that suggest that loss in felting power is caused by formation of degraded layers of protein material in the fibre. 56 references.

C.O.C.

Pathways of Capillary Migration of Liquids in Textile Assemblies

F. W. Minor, A. M. Schwarz, L. C. Buckles, and E. A. Wulkow *Amer. Dyestuff Rep.*, 49 (13 June 1960) 419-424

Evidence confirms that the capillary migration of representative organic liquids within yarns follows the $s^2 = kt$ relationship derivable from the Washburn equation (*Phys. Rev.* 17 (1921) 273) where s = height of rise in a capillary tube and t = time. When for any complex capillary system s^2 plotted against t yields a straight line then the system is analogous to a narrow cylindrical tube, follows Washburn's equation and the radius of the system (equivalent to that of a tube) is constant. This relationship is also followed when the liquids move by capillarity in each of the three mutually perpendicular directions within a typical cloth, i.e.

Developments in Continuous Bleaching with Sodium Chlorite

W. Marty

Textil-Rund., 15 (April 1960) 202-207

Description, with diagrams, of the Benninger Model TFA machine for continuous bleaching of fabrics. A new feature is a long, horizontally disposed reaction chamber with capacity for over 2,000 lb. of fabric. L.A.T.

PATENTS

Bleaching with Hydrogen Peroxide or Peroxide Compounds

Unilever

BP 836,988 (27 July 1955)

More effective bleaching is obtained below the boil, e.g. at 50-60°C., if an organic carboxylic ester having one or more ester groups in the molecule is present. The ester must give a titre of < 1.5 ml. 0.1 N-Na₂S₂O₃ when tested as follows: to a solution at 60°C. made up of distilled water (1000 ml.), Na₂P₂O₇·10H₂O (2.5 g.), NaBO₂·H₂O·3H₂O (0.615) and Na tetratropylenebenzene sulphonate (0.5) is added an amount of ester in equimolecular ratio to the available oxygen. The mixture is stirred by a 0.75 in. glass stirrer at 600 r.p.m. for 5 min. while keeping at 60°C. Then 100 ml. are withdrawn, immediately pipetted into a mixture of crushed ice (250 g.) and glacial acetic acid (15 ml.), and KI (0.4 g.) is added. The liberated iodine is immediately titrated with 0.1 N-Na₂S₂O₃ with a starch indicator until the first disappearance of the blue. A suitable ester is the benzoyl ester of commercial Na or K phenol sulphonate. C.O.C.

Dry Cleaning Industrial Leather Gloves

Printar Industries

BP 838,852 (9 Jan 1957)

The solvent used contains in dispersion an aqueous solution of a disinfectant ammonium compound, the amount of water being such that when the solvent has evaporated the treated material appears to be dry. The treated gloves have a residual bacteriostatic effect which lasts for many months. C.O.C.

Pathways of Capillary Migration of Liquids in Textile Assemblies (VI p. 567)

VIII—DYEING

Theoretical Considerations of the Dyeing of Cellulose Acetate with Disperse Dyes

H. J. White *Text. Research J.*, 30 (May 1960) 329-338

Two models for the dyeing process were considered, one based on mixing the polymer segments with absorbed molecules and the other based on absorption on to sites within the fibre. Consideration of experimental results caused the model based on mixing to be rejected as unsatisfactory. The model based on absorption on to sites was qualitatively consistent with most experimental results available. Thus it is capable of supplying the linear isotherm from aqueous solution observed experimentally and is consistent with existing results on effect of temperature on the isothermal effects of change of solvent. Differences that exist on comparison with results on absorption from the vapour phase are probably attributable to effects not explicitly considered in the simple theory. C.O.C.

Pad-Roll Dyeing

J. Renggli

Textil-Rund., 15 (April 1960) 184-190

A discussion of more important variables in pad-roll dyeing (Rydholm system). The prepared fabric is padded with dye and the necessary dyeing assistants, passed between the infrared heaters to raise the cloth to the temperature required for fixing the dye (50-95°C.), and then batched up on a large-diameter roller in the hot chamber. The roll is then slowly rotated and maintained under controlled conditions of temperature and humidity. A difference of about 5°C. between the dry- and wet-bulb thermometers is maintained. Live steam is injected into the heating zone as required, and the number of heating elements is varied to maintain humidity and temperature reasonably constant. L.A.T.

Twelve Million Yards of Natural and Man-made Fibres dyed on the Swedish Pad-Roll Dyeing Machine

R. M. Lesh *Amer. Dyestuff Rep.*, 49 (2 May 1960) 306-309

An account of two-years' use of this machine by the Northern Dyeing Corp., Washington, N.J. Its advantages

are: (1) economy in labour, (2) 96% colour yield, (3) optimum penetration, (4) versatility in the fabrics that may be dyed, (5) uniform dyeings in large runs, and (6) perfect repeat of dyeings once they are standardised. The disadvantages are: (1) lengthy, extremely accurate laboratory work needed for matching, (2) any error, either in the dyestore or in the dyer's state cannot be noticed before dyeing is complete, (3) standardising of dyes must be very accurate or the states will not give repeats, (4) a well-bottomed piece is far more essential than for any other type of dyeing, (5) lots of < 2500 yards cannot be dyed advantageously although as little as one piece may be dyed, (6) "clean-up" time for deep dyeings is sometimes difficult, (7) constant attention to all details and close control of the dyeing as a whole is essential. The firm's experience is that the advantages outweigh the disadvantages. C.O.C.

Modern Methods of Continuous Dyeing

R. Kern

Textil-Rund., 15 (April 1960) 168-183

A review of continuous dyeing, especially pad-jig, pad-roll, and pad-steam, with particular reference to steaming under pressure at 120°C. Results show that under these conditions there is a saving of time, steam, and labour. The colour yield with most dyes is higher. The technical problems connected with high-temperature continuous steaming have been overcome by the Swiss firm Konrad Peter A.G. and suitable machinery is commercially available. L.A.T.

Calculations in Padding with Azoic Coupling Components

R. Loss

S.V.F. Fachorgan, 15 (April 1960) 270-272

In general Azoic Coupling Components are substantive on cellulose. In pad dyeing this substantivity effect has to be allowed for when calculating padding liquor additions to maintain constancy of shade. At a given temperature the uptake of Naphtol depends on the speed of the fabric and the liquor ratio. Formulae required for calculations are derived from first principles and worked out examples are given for Naphtol AS and AS-TR (C.I. Azoic Coupling Components 2 and 8). L.A.T.

Preparation of Non-phototropic Blue and Turquoise Dyeings by Pad-Steam Methods

H. Goorhuis

Textil-Rund., 15 (April 1960) 195-197

Resin-treated dyeings are often phototropic, depending on the type of resin and catalyst used. It is claimed that non-phototropic dyeings can be obtained with phthalocyanine Panduran dyes (Durand & Huguemine). The fabric is padded with dye liquor containing a little chromium acetate and some NaCl to inhibit migration of colour during drying. The dried material is passed first through a cold chroming bath containing 200 g./l. NaCl, and then into saturated steam at 102-105°C. for 40-80 sec. After a cold rinse hot chroming takes place, followed by soaping. L.A.T.

Absorption Isotherms of Direct Dyes on Vinyon and Cotton

K. Fujino, F. Fujimoto, and M. Kawaguchi

J. Soc. Textile Cellulose Ind. Japan,

15 (July 1959) 576-581

The adsorption isotherms of 29 direct dyes on Vinyon and cotton have been determined. If D is the amount of dye taken up (g/100 g. fibre) after 5 hr. at 90°C., and c is the final concentration (%) of dye in solution, the results are found to fit an equation of the form—

$$D = \frac{abc}{1+bc} + kc$$

where a , b and k are constants characteristic of each dye and fibre. A complete table of these constants is given, corresponding to given dye structures, showing that in some cases the cotton absorbs more than the Vinyon whereas in others this behaviour is reversed. The authors then classify the dyes into 3 groups. In (1), the amount of sorbed dye is small and the same for both fibres. In (2), the amount sorbed by Vinyon is greater than that by cotton at low dye concentration but this is reversed at high concentration. In (3), both fibres sorb large amounts, but Vinyon always takes up more than the cotton. The relation between the molecular structure of the dye and its dyeability on Vinyon is almost the same as that for cotton. The presence of an -NH₂ group has a better effect than that of an -OH group. The peri-type combination of

NH₂ with OH and OCH₃ groups on a benzidine ring has poor dyeability. On the other hand, dyes having a salicylic acid residue are quite effective. Dyes with many sulphonic acid groups or those with them all on one side of the dye molecule are not very effective in dyeing Nylon.

L.P.

Dyeing of Acrilan 16 and Acrilan 16/Acrilan Blends

T. E. Croxson

Amer. Dyestuff Rep., 49 (2 May 1960) 314-318

Acrilan 16 has basic physical properties very similar to those of Acrilan but the dyeing properties are very dissimilar. Disperse dyes which dye Acrilan to any depth build only to medium heavy dyeings on Acrilan 16 and are not practical for dyeings requiring > 4% dye. The fastness on Acrilan 16 is better than on Acrilan. Basic dyes go on to Acrilan 16 quicker than on to Acrilan and a retarding effect has to be given. A full range of dyeings from light to heavy is obtainable on Acrilan 16 whereas on Acrilan not more than medium heavy dyeings can be obtained. Acid dyes have no affinity for Acrilan 16 but dye Acrilan readily from a strongly acid bath. A practical method is described of production of two-colour effects on a blend of the two fibres from a single bath. Selected basic dyes are used for the Acrilan 16 and selected acid dyes for the Acrilan. They are applied from a strongly acid bath containing an agent which prevents coprecipitation between the acid and basic dyes.

C.O.C.

Application of Ultrasonics in Dyeing

Ya. Kh. Shtivel'man

Tekstil. prom., 20 (March 1960) 71-72

Dye liquors were subjected to ultrasonic waves of frequency 22 kc./sec. produced by a magnetostricting generator. The treatment is said to improve the dissociation of the dye and its diffusion into fibre. There were however difficulties in obtaining uniformity of treatment. It is therefore suggested ultrasonic vibrations can be used only for treating the dye liquor before dyeing commences.

L.S.L.

PATENTS

Application of Anthraquinonoid Reactive Dyes

ICI

BP 838,336 (18 April 1956)

Anthraquinone dyes (I) containing < 1 ionogenic solubilising gp. and < 1 NH₂ gp. or NH₂ gp. subst. by a 1,3,5-triazine radical containing < 1 halogen atom, are applied to cellulosic fibres by treating the fibre in aq. medium containing > 3% by wt. of an acid binding agent and simultaneously or subsequently with an aq. soln. of I. The method is an improvement over those of *BP 798,121* (J.S.D.C., 74 (1958) 792) in that no alkali-cellulose is formed and the fibre strength is unaffected. Thus, cotton (100) is padded at room temp. with an aq. soln. containing, e.g. 1% Na₂CO₃ (A) or 3% NaOH (B), and roller squeezed to wt. 200 before drying at 100°C. The fabric may then be (A) padded in an aq. soln. containing the dye (II) from 1-amino-4-(4'-aminoanilino)anthraquinone-2,3,5-trisulphonic acid and cyanuric chloride, roller squeezed to wt. 200, steamed 1 min. at 100°C., rinsed in H₂O and dil. NaHCO₃, soaped, rinsed and dried to a greenish blue of excellent light and washing fastness, or (B) printed with a paste of II (3), urea (5), H₂O (57) and 5% Na alginate (35), dried, steamed, rinsed and soaped to a blue print of excellent fastness.

A.T.P.

Dyeing Animal Fibres or Hair

Société Monsavon l'Oréal

BP 840,904 (France 13 Oct 1956)

Dyes having direct affinity for the fibre without need for any chemical transformation such as oxidation, coupling or mordanting, are readily applied at < 50°C. by dissolving them in a > 10% aqueous solution of butanol, or an aralkanol, cycloaliphatic alcohol or heterocyclic alcohol. Dyes of many classes, e.g. nitro, acid, disperse, basic, may be applied by this method. Thus live grey hair treated at room temperature for 15-20 min. with an aqueous solution containing 1% Supracid Black R (C.I. Acid Black 22), 1% β-phenylethyl alcohol, and 3% lactic acid and then rinsed, is dyed deep grey.

C.O.C.

Dyeing Wool with Reactive Dyes Containing Halogeno-s-triazine Groups

ICI

BP 838,312 (15 Oct 1957)

Dyes of the azo, anthraquinone, nitro, and phthalocyanine series containing halogeno-s-triazine groups which react with cellulose in presence of alkalis, tend to give

skittery dyeings on wool, especially if > 1 SO₃H group is present in the molecule. By dyeing in presence of 0.5-10% on the weight of fibre of a cationic surface-active agent, however, level dyeings of good fastness to potting can be obtained on wool yarns and slubbing.

E.S.

Dyeing Fur Skins while leaving the Tips White

FH

BP 835,766 (Germany 24 Sept 1955)

The tips of the fur are treated with an aqueous dispersion of a water-insoluble resin and a thickening agent which is soluble or swellable in water, and dried. The fur skin is then dyed in the usual manner, after which the resist is removed by simple treatment with a detergent. This leaves the fur with white tips which do not yellow when exposed to light or air after storage.

C.O.C.

Azoic Dyeing of Leather

General Aniline

USP 2,913,301 (31 Oct 1955)

The leather is treated with an aqueous solution of azoic coupling component free from solubilising groups. The pH is > 7 at the start and > 7 at the finish. On subsequent coupling with an azoic diazo component, well-penetrated dyeings of good fastness to washing, rubbing and light are obtained. The process tends to cover up any surface imperfections in the leather. When the azoic coupling component contains at least one aromatically bound free amino group, even more uniform, level dyeings of improved fastness to dry cleaning are obtained. Alternatively an azoic composition can be used under the same pH conditions.

USP 2,913,302 (31 Oct 1955)

Stronger, more uniform dyeings are obtained if the azoic coupling component or azoic composition is applied in presence of a formaldehyde yielding substance and, if desired, an alkyl or alkylolamine.

C.O.C.

The Monforts Reactor—A New Continuous Dyeing Machine (I p. 557)

Esterophile Dyes for Dyeing and Printing Polyester Fibres (IV p. 558)

Reactive Dyes—Water-soluble Anthraquinonoid Compositions (IV p. 561)

Pathways of Capillary Migration of Liquids in Textile Assemblies (VI p. 567)

IX—PRINTING

PATENTS

Printing Process for Reactive Dyes

ICI

BP 838,334 (7 March 1956)

Water-soluble azo or anthraquinone dyes containing a 3,5-dihalogeno-2,4,6-triazinylamino group are printed on to protein and/or regenerated protein fibres, the fibre optionally dried, and steamed to give prints of very high fastness to light and washing. The printing paste may contain thickening agent, e.g. Na alginate, solubilising agent, e.g. urea, glycerine, and especially NaCl where the fibre is wool, and an acid-binding agent, e.g. Na₂CO₃, or a precursor thereof, e.g. NaHCO₃, or Na trichloroacetate. Thus, the paste obtained by adding a soln. of H₂O (5), urea (5) and the azo dye (5) orthonilic acid → (3,5-dichloro-2,4,6-triazinylamino)-8-hydroxynaphthalene-3,6-disulphonic acid to 5% aq. Na alginate (40) is screen printed on to chlorinated wool, the fibre dried, steamed 30 min., rinsed with cold H₂O, and soaped 5 min. at 50°C. in 0.2% soap solution (100) to give a bright red print of good washing and light fastness.

A.T.P.

Printing Reactive Dyes on Cellulose

ICI

BP 838,339 (4 Sept 1956)

When a reactive dye having a dihalogeno-s-triazine group is to be printed alongside a diazo compound on to cotton previously impregnated with a caustic alkali solution of an arylide of 3-hydroxy-2-naphthoic acid, incorporation of an alkali-metal sulphite or bisulphite in the printing paste ensures proper development and leads to a stronger print. A suitable addition is e.g. 1.5% on the weight of printing paste of potassium sulphite liquor (sp.gr. 1.45).

E.S.

mm'-Dioxyphenols as Diazotype Coupling Components

General Aniline

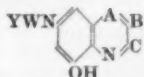
BP 840,945 (U.S.A. 19 Feb 1957)

mm'-Dioxyphenols, e.g. mm'-ethylenedioxydiphenol, are excellent coupling agents for use in diazotype compositions. They have satisfactory visual and high actinic

opacity, the latter enabling use of shading couplers to enhance the visual opacity even further without seriously affecting the actinic opacity. While readily and completely developing with ammonia they have such low pre-coupling activity that they can be used satisfactorily with *p*-4-morphinylbenzenediazo complexes which have hitherto been unusable. C.O.C.

6-Amino-8-hydroxyquinolines as Coupling Components for Azine Dye Images

General Aniline BP 837,360 (U.S.A. 21 Feb 1957)
Compounds of formula—



(W = Alk, hydroxyalkyl, carboxyalkyl, sulphaalkyl, phenyl or subst. phenyl, alkoxyphenyl, carboxyphenyl or sulphophenyl; Y = H, acyl or sulphonyl; A = H, carboxyl or carbamino; B and C = same or different, H, Alk, phenyl or subst. phenyl), e.g. 6-(β -hydroxyethylamino)-8-hydroxy-2-phenylquinoline acid, yield magenta azine dye images by development with *p*-phenylenediamine followed by bleaching and fixing. C.O.C.

Prevention of Fading of Cyan Dyeings in Colour Developed Prints and Films

General Aniline USP 2,913,338 (10 Jan 1957)
Treating the finished print or transparency with an aqueous solution of Ca, Mg, or Cd salts, e.g. CdBr₂, confers high resistance to cyan dye fading or discoloration. C.O.C.

Ceramic Transfers

Buntpapierfabrik BP 837,874 (Germany 4 April 1957)

Transfers for underglaze application and which need only a single firing step are obtained by applying in any sequence, on a carrier having a water-soluble finish, (a) the design in ceramic colours with a binder based on varnish, drying oil or lacquer and (b) a film of a carboxyl-group-containing polyvinyl compound. C.O.C.

Esterophile Dyes for Dyeing and Printing Polyester Fibres (IV p. 558)

Reactive Dyes—Water-soluble Anthraquinonoid Compositions (IV p. 561)

Anhydrocyanine Dyes (IV p. 564)

X—SIZING AND FINISHING

Man-made Cellulose Fibres in "Wash-and-Wear"

A. B. Hilton, G. V. Lund, and A. E. Martin
Amer. Dyestuff Rep., 49 (30 May 1960) 392-398

Viscose rayon staple fabrics can be given excellent "wash-and-wear" performance but fabric construction is just as important as the correct finish. The factors involved appear to be (1) coarser shorter fibres help, (2) lower-twist coarser yarns help, (3) open weaves help, basket weaves are easier than twills, and (4) heavier fabrics are easier. Cross-linked cellulosic fibres alone lend themselves to more dimensionally stable fabrics with some degree of "wash-and-wear". It seems, however, that the maximum "wash-and-wear" potential for such fibres lies in blends with synthetic-polymer fibres. High-modulus fibres, e.g. SM-27 [Courtaulds (Alabama)] when finished with the customary amounts of resin used for cotton, have good "wash-and-wear" properties. C.O.C.

Progress in "Wash-and-Wear" finishing of Cellulosic Fabrics

T. J. Cronin
Amer. Dyestuff Rep., 49 (30 May 1960) 389-391, 398

A discussion of the present status of "wash-and-wear" finishing of cotton and rayon fabrics, including recent developments in crease-proofing agents. The limitations of available finishes are considered from the standpoint of improvements which may be forthcoming from current research. 14 references. C.O.C.

A New Reactant Resin (Resloom E-63) for "Wash-and-wear" finishing of Cotton Fabrics

C. R. Williams
Amer. Dyestuff Rep., 49 (13 June 1960) 431-438

The performance characteristics of modern cotton

finishing systems are reviewed (36 references) and compared with the ideal performance that could be expected within the limitations of the covalent cross-linking theory. Each system provides a different compromise of properties and not one of them approaches ideal performance. Resloom E-63 (Monsanto), an aqueous solution of the methylol derivative of a heterocyclic, nitrogenous compound, when correctly used with softeners, wetting agents and other additives of adequate performance, gives results superior to those obtained with other nitrogenous resins. In particular it is as resistant as the triazones to chlorine damage. C.O.C.

Treatment of Cotton Flannelettes before Brushing

B. N. Mylnikov and F. A. Kutkin

Tekstil. prom., 20 (April 1960) 52-53

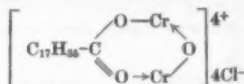
Cotton flannelettes were treated with several emulsions, brushed and examined for quality and finish, fabric strength and yarn strength. The following substances were tried as brushing assistants: synthetic fats, sulphated fatty acids, "leather paste", chlorinated paraffins, a mixture of paraffin and stearine and a number of oils. The best results were obtained when treating cotton with 1-5% emulsions containing per litre (a) 100 g. synthetic fats, 5 g. paraffin and 3 g. 25% ammonia, or (b) 10 g. sulphated fatty acid, 5 g. paraffin and 3 g. 25% ammonia. L.S.L.

Water-proofing of Cellulosic Fabrics

N. D. Mal'tser and O. I. Aganova

Tekstil. prom., 20 (May 1960) 18-20

A complex salt of chromium chloride and stearic acid "Chromolan"—



has been successfully used for water-proofing fabrics. The reagent is strongly acidic and inflammable and therefore for storage and handling it is mixed with water in 1:2 or 1:1.5 ratios. Fabric is padded in a suitable solution containing e.g. per litre (a) 80 g. "Chromolan" and 6 g. hexamethylenetetramine (to bring to pH 4.0-4.5), or (b) 80 g. "Chromolan", 10 g. glacial acetic acid, 6 g. hexamethylenetetramine, (c) 42 g. "Chromolan", 10 g. glacial acetic acid, 5-8 g. hexamethylenetetramine to get 70-80% expression, and dried on standard equipment, e.g. stenter or drying cans. The treated fabric is fast to washing and has decreased tendency to shrink, but is a pale bluish green and therefore unsuitable for whites and pastel dyeings. L.S.L.

Fully Automatic Scouring of Wool Fabrics

E. G. Tokar' *Tekstil. prom.*, 19 (Feb 1959) 47-49

Equipment for fully automatic scouring of wool fabrics is described in detail. It consists of a control box, proportioning hopper, water-level control, thermostat, mixer, and membrane valves with electromagnetic relay. The control box contains graduated timing relay, intermediate electromagnetic relay, tumbler switches for hand control and indicating system. The control box can vary the length and order of the individual operations. L.S.L.

Treatment of Fabrics with Organic Silicones

N. V. Kalugin *Tekstil. prom.*, 20 (March 1960) 58-61

A short review of the development of these compounds in the U.S.S.R. Two preparations, GKZh94 obtained by hydrolysis and polymerisation of ethyldichlorosilane and GMS9 (polysiloxane), were evaluated on cotton. Ethyl orthotitanate was a suitable catalyst. L.S.L.

Finishing of Fabrics Containing Wool and Nitron

E. S. Roskin and V. S. Fel' *Tekstil. prom.*, 19 (Feb 1959) 54-56

Fabrics made from yarns containing wool and Nitron have softness and depth of handle similar to all wool fabrics. Nitron increases the strength of the yarn and is not affected by carbonising. In amounts below 30% it will have little effect on the milling and raising properties of the fabrics. L.S.L.

PATENTS

Resin Finish resistant to Chlorine Retention

DuP USP 2,911,326 (8 Nov 1960)

The sensitivity to chlorine of cellulosic cloth treated with dimethylol di(methoxymethyl) urea (USP 2,825,710,

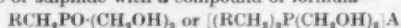
J.S.D.C. 75 (1959) 60), is effectively overcome if zinc nitrate is used as the catalyst. C.O.C.

Water-repellent Finish

Stanford Chemical Co. USP 2,913,427 (25 June 1957)
A composition suitable for application to dry-cleaned or laundered fabrics of both natural and man-made fibres consists of a solvent solution of a surface-active copolymer of an unsaturated olefinic compound containing a basic N atom and an oleophilic compound, e.g. naphtha solution of the copolymer of dodecyl methacrylate and diethyl-aminoethyl methacrylate. The garments are either dipped into or sprayed with the solution. Finally they are treated with a solvent mixture of a wax and an ester gum. Alternatively the copolymer solution contains a suitable wax and a wax-compatible hardening resin, e.g. paraffin wax and lined resin. C.O.C.

Flame-resistant Finish

U.S. Secretary of Agriculture USP 2,911,325 (5 June 1956)
Polymers formed by reaction of a 1-aziridinylphosphine oxide or sulphide with a compound of formula



(A = monovalent anion; R = OH or a radical produced by the reaction of the OH of a PCH_2OH group with a nitrogen compound containing at least one trivalent N atom and at least one H or CH_2OH attached to the N atom) are used. Thus cotton cloth was impregnated with an aqueous solution containing 10% tris(1-aziridinyl)-phosphonium sulphide, 10% tetrakis(hydroxymethyl)-phosphonium chloride, 2% triethanolamine and 4% methylolamine, dried, heated for 3 min. at 160°C., washed in hot water and dried. The treated cloth was strong, had a good handle and was highly flame resistant. C.O.C.

Sheet Materials

Snia-Viscosa (Societa Nazionale Industria Applicazioni Viscosa) BP 835,914 (Italy 31 Jan 1956)

Fabric, preferably woven of thermoplastic synthetic linear polymer yarns, is stiffened with a synthetic resin filler so as not to conceal the structure of the fabric. The resin should be such that if separated from the fabric it is self supporting. The product is suitable for being written or printed upon or as a base for photographs. C.O.C.

Application of Thin Coatings

E. Elod BP 835,287 (Germany 15 Feb 1956)

Thin layers of metals or dyes are applied to materials, especially those which do not lend themselves to direct deposition of metals or dyes vaporized in high vacuum, by applying the dye or metal as vapour in a high vacuum to a transfer sheet whose surface at least is hydrophilic and then transferring the coating to the material to be coated. The surface of the material to be coated is first treated with an adhesive. C.O.C.

Applications of Dichlorophen in the Textile Industry (III p. 557)

Changes in Fine Structure and Mechanical Properties Induced by Cyanoethylation of Cotton Yarn. Part I—Treated without Tension (VI p. 567)

Reaction of Wool with Oxidising Agents in Concentrated Salt Solutions (VI p. 567)

Pathways of Capillary Migration of Liquids in Textile Assemblies (VI p. 567)

Colouring Synthetic Polymers a Fast-to-light Brown (VI p. 568)

Effect of Heating and Drying on Accessibility of Cellulose (XI this page)

Penetration of Electrolyte Solutions into Cellulose Fibre (XI this page)

XI—PAPER AND OTHER CELLULOSIC PRODUCTS

Effect of Heating and Drying on Accessibility of Cellulose

O. Ant-Wuorinen and A. Visapää

Paperi ja Puu, 42 (May 1960) 317-326 (in English)
Effect of boiling water and of boiling buffer soln. of pH 7 on bleached cotton linters, bleached sulphite pulp and viscose rayon was studied before and after mercerisation by determining the carboxyl content, X-ray

characteristics, pH, DP and solubility. In all cases accessibility decreased markedly. Drying at 105°C. and in vacuum over P_2O_5 at room temp. also decreased accessibility. R.A.

Penetration of Electrolyte Solutions into Cellulose Fibre

O. Ant-Wuorinen and A. Visapää

Paperi ja Puu, 42 (Feb 1960) 33-42 (in English)
Cotton, wood cellulose and regenerated cellulose behaved similarly when the penetration of NaCl and HCl was studied using air-dry and water-pretreated samples. In salt, air-dry fibre first takes up water preferentially, showing lower salt concn. inside the fibre than in the soln. On prolonged contact with salt soln. the concn. inside the fibre rises slowly until in equilibrium with the outside soln. Pretreatment for 2 hr. with water had a marked effect. In the initial period the concn. of salt soln. was the same inside and outside the fibre. On prolonged contact, the concn. inside the fibre decreased but after 7 days' contact it again rose to reach an equilibrium. When air-dry fibre was immersed in acid the concn. in the initial period was the same inside and outside the fibre. Penetration of electrolyte soln. into cellulose fibre is a slow, complicated process, depending on the interaction between swelling phenomena and the ions finding various opportunities of penetration of the cavity matrix of the fibre. The authors reject the concept of "non-solvent water". R.A.

Rheology and the Paper Coater

W. R. Willets *Off. Dig. Fed. Soc. Paint Technology*, 32 (May 1960) 591-613

The complexity of paper-coating machines (several of which are shown diagrammatically, and discussed) necessitates the rheological study of the flow properties of the colours applied thereon. Single-point measurements of viscosity are inadequate, and viscometers indicating properties such as thixotropy and dilatancy are essential. The effect of the rheological characteristics of the base sheet on the coating operation is referred to, as well as the importance of viscoelastic properties on the end-use requirements of the finished sheet. There is a substantial bibliography. J.W.D.

Surface Smoothness of Paper

A. Andersson

Svensk Papperstidning, 63 (15 June 1960) 356-368

A comprehensive literature review covering definitions, methods of measuring and factors influencing the surface smoothness of paper and its effect on printability. 60 references. R.A.

Controlled Thermal Decomposition of Cellulose Nitrate. VII—Carbonyl Compounds

M. L. Wolfmont and G. P. Arsenault

J. Amer. Chem. Soc., 82 (5 June 1960) 2819-2823

Some carbonyl compounds resulting from controlled ignition of cellulose nitrate (N content 12-6%) sheet, cast from ethyl acetate, have been isolated as 2,4-dinitrophenylhydrazine derivs. and found to be acetone, acetaldehyde, formaldehyde, methylglyoxal, mesoaldehyde and hydroxypyruvaldehyde. Gas-liquid partition chromatography was used to demonstrate presence of acetone, acetaldehyde, acrolein, ethyl acetate, hydrogen cyanide and an unidentified product which is not a carbonyl compound. Origin of the isolated products is discussed. F.J.

Chemistry of Xanthates and Viscose (VI p. 567)

Colouring Synthetic Polymers a Fast-to-light Brown (VI p. 568)

XIII—RUBBER; RESINS; PLASTICS

Monomer-modified Epoxy-drying Oil Resins (V p. 564)

Coloured Polyesters (VI p. 568)

Fibre- and Film-forming Polyamides (VI p. 568)

Colouring Synthetic Polymers a Fast-to-light Brown (VI p. 568)

XIV—ANALYSIS; TESTING; APPARATUS

Measurement of Flow Properties in the Coatings Industry (V p. 566)

Instruments to Measure Flow Properties of Printing Inks (V p. 566)

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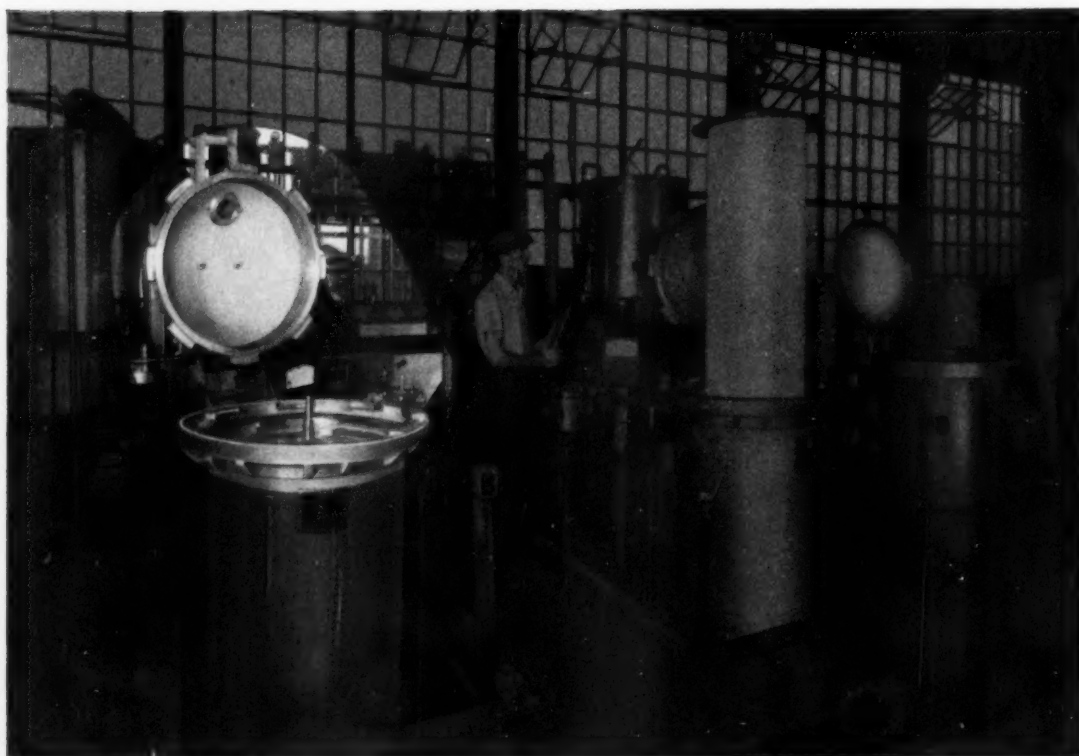
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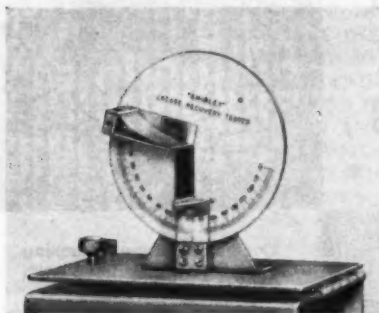
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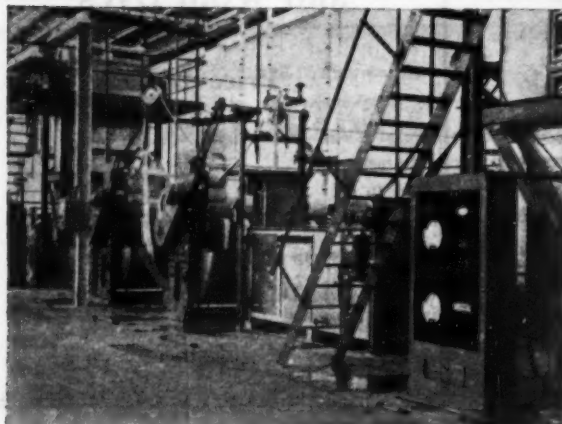
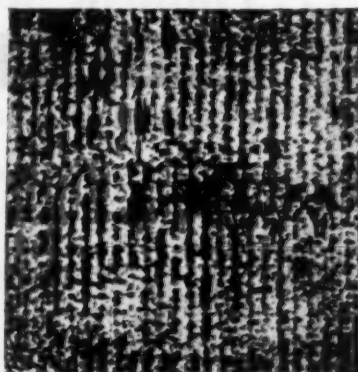
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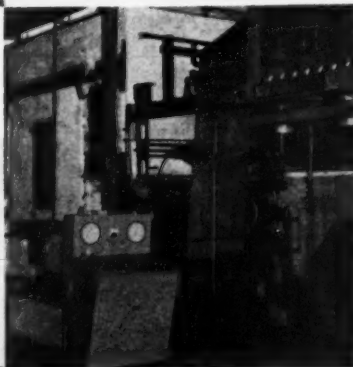
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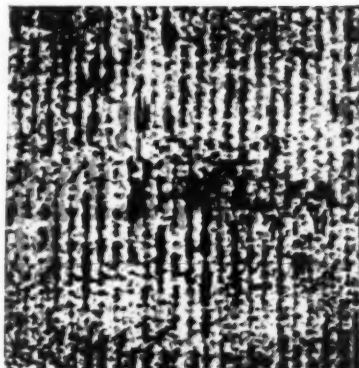
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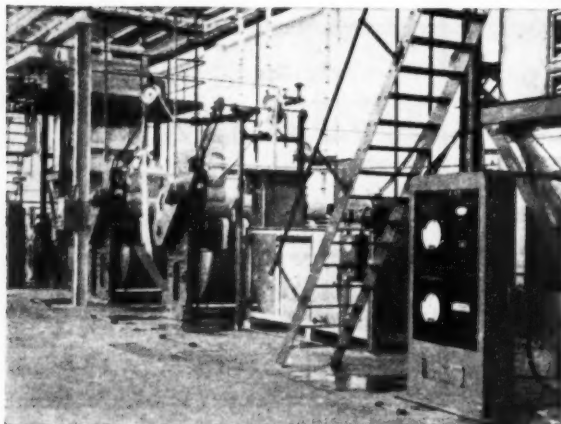
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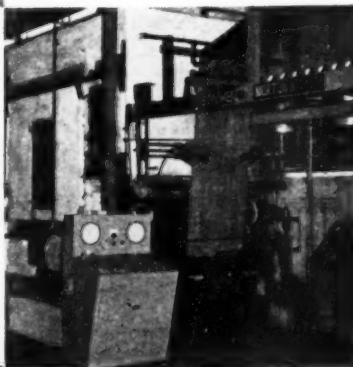
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